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THE PLANT DISEASE BULLETIN

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THE PLANT DISEASE SURVEY

Supplement 26 – 31

Diseases of Field and Vegetable Crops

In the United States in 1922

June 15, 1923

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

DISEASES OF FIELD AND VEGETABLE CROPS IN THE UNITED STATES IN 1922

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CONTENTS

Introduction 2
Potato - Seed certification..... 6
Diseases..... 8
Late blight..... 8
Early blight 11
Fusarium wilt 14
Wart 17
Rhizoctonia 19
Scab 24
Blackleg 28
Mosaic 31
Leafroll 35
Tipburn and hopperburn 37
Other degeneration diseases..... 40
Yellow dwarf..... 43
Poor stands, etc. 45
Use of sulfur on cut seed.... 45
Miscellaneous parasitic diseases 46
Miscellaneous non-parasitic diseases 49
General references on potato diseases 52
Diseases of tomato 53
Leaf spot 53
Fusarium wilt 55
Western yellow blight 59
Early blight and nailhead spot 59
Mosaic 61
Blossom-end rot 62
Leaf mold 64
Bacterial blight 64
Root knot 64
Miscellaneous
Affecting stem 65
Affecting fruit or blossom 66
New diseases 67
General references 67
Sweet potato - Certification 69
Diseases 80
Diseases of bean 89
Diseases of Lima bean 96
Diseases of onion 97
Diseases of crucifers 100
Cabbage..... 100
Brussels sprouts..... 109
Cauliflower 109
Chinese cabbage 110
Cress 110
Horse radish 110
Kale 110
Mustard 110
Radish 111
Rutabaga 111
Turnip 111
Diseases of cucurbits 112
Cantaloupe 112
Citron 114
Cucumber 114
Pumpkin..... 119
Squash 119
Watermelon 120
Diseases of cotton 123
Diseases of sugar cane 129
Diseases of sugar beet..... 132
Diseases of tobacco 135
Diseases of miscellaneous vegetable crops 143
Artichoke 143
Asparagus 143
Beet (garden) 144
Carrot 145
Celery 146
Chicory 149
Eggplant 149
Endive 150
Escarole 151
Ginseng 151
Lettuce 151
Mangel 155
Okra 155
Parsley 155
Pea 156
Peanut 159
Pepper 160
Rhubarb 160
Salsify 161
Spinach 161
Swiss chard 163

INTRODUCTION

The general plan of the preceding years has been followed in summarizing the data on the vegetable diseases of 1922. An attempt has been made to include in the references the more accessible articles, and even brief abstracts of the points which were of most interest. It is hoped that this may be of benefit to some of the men who deal with vegetable pathology, and who may not have all the references readily available.

Notes on Geographic Distribution

In looking over the Plant Disease Survey reports one is impressed, in a number of cases, with the apparent lack of information regarding the cause of a certain trouble in a given state. For instance, on rhubarb Ascochyta rhei, Cercospora, Phyllosticta, Alternaria and possibly others have been reported. Are all of these in the same states, or are they distributed among the different states? Again various bacteria such as viridilividum, vitians, marginale and rhizoctonia, as well as a number of unidentified species, have been reported on lettuce. What is the geographic range of each? Are they all found in the same territory, or have they definite limited areas? These points, as well as others of a similar nature, should be made clear by the collaborators the coming season.

There is a root rot in nearly every locality where peas are grown. F. R. Jones has done much to clarify the situation regarding the cause of these root rots. Fusarium, Pythium and Rhizoctonia are concerned. Are all of these fungi responsible? If so, are they intermixed or have they definite boundaries? Is the leaf spot on parsley which the collaborators report, caused by Cercospora or by Cercosporella, or both? The bean root rots evidently are everywhere, but few of the reporters are sure of the organism connected with the disease. Is it caused by Fusarium, Rhizoctonia, Thielavia, or others, and what is the geographical distribution of each? Septoria consimilis and Septoria lactucae have been reported on lettuce. Which is the more common? What is their distribution? With the western yellow blight of tomato, Corticium, Fusarium, etc. are given as the cause. These are examples of some of the numerous problems that the Plant Disease Survey organization can assist in solving.

Table 1. Some of the new areas from which well known diseases of vegetables and field crops have been reported to the Survey for the first time.

Disease	Host	Place where found
Angular spot	Tobacco	Connecticut, South Carolina (Prior to 1921 reported only from Virginia - now known in nine states.)
Wildfire	"	New Hampshire, New York, Florida
Mosaic	Celery	New Jersey (Is spreading, now in Indiana and Minnesota.)
Bacterium vesicatorium	Tomato	Kansas
Rust (Uromyces)	Pea	Minnesota (Previously reported from Nebraska and North Dakota.)
Yellows	Celery	New York, Pennsylvania (In New York one man lost 100,000 plants through this disease.)

Ecological observations

Ecological factors have an important bearing on the severity of many diseases. This is suggested particularly in the summaries of downy mildew of lettuce, potato mosaic, late blight of potato, black leg of potato, and onion smut. Septoria pisi has been reported on peas only from the northern states although a trace was reported from Texas one year. It would be interesting to know whether it occurs in other southern states or whether the temperature limits it to the North. Septoria lycopersici is most severe south of Pennsylvania and the Ohio River and east of the Mississippi. Tomato wilt (Fusarium lycopersici) was found on both sides of the lower Mississippi and Ohio Rivers. An epidemic of Macrosporium solani in New York, Illinois, and West Virginia was reported. What were the factors influencing this outbreak?

New Diseases

Table 2. New diseases reported during 1922. (See following text for details.

Host	Place	Disease	Reporter
Carrot	Texas	Rio Grande disease	Taubenhaus
Spinach	Washington, Oregon	Puccinia subnitens	Barss (Alkali grass the telial host growing near. Often reported before on different Chenopodiums but never on spinach.)
Swiss chard	Texas	Bacterial	Taubenhaus
Spinach	Idaho	Fusarium (stunting)	Hungerford
Lettuce	Florida	Alternaria	Foster
Potato	Pennsylvania	Giant hills	Nixon
Radish	Missouri	Erysiphe polygoni	Maneval
Chinese Cabbage	Texas	Aphelenchus olesistus	Taubenhaus (A leaf nematode)
Bean	Published in Science	Bacterium flaccumfaciens	Hedges
Watermelon	U. S. D. A.	Pythium (blossom end)	Drechsler
Watermelon	Washington	Rhizoctonia	Heald
Sweet potato	Texas	Macrosporium solani	Taubenhaus
Tomato	California	Basisporium gallarum	
Tomato	California	Alternaria	
Tobacco	Wisconsin	Bacterial leaf spot	

Yellow dwarf which has been described in New York is one of the most menacing of the newer potato diseases. It evidently does not come under the mosaic or leaf roll types. It is not only carried in the seed but is also carried in the soil and when once introduced into a field, remains indefinitely. The disease has been found in nearly every county in the state and has been seen in New Jersey, Pennsylvania, and Vermont.

Work on the mosaic diseases

Great effort has been applied to the work with degeneration type of diseases. The transmission of the disease from one host to another has received much attention. The lack of agreement on this subject is made evident by the statements of Elmer, Fernow and Valleau. (See mosaic diseases of potato and tobacco.)

The most talked about work has been done in an attempt to discover the cause of mosaic. The reader is referred to the work of Palm, Smith, Kunkel, Nelson, McKinney and others. (See potato mosaic.)

The division of the degeneration diseases of potato and the names applied by different workers give one an impression of the complicated nature of the problem. Some of the names are as follows:

Mosaic	Leafroll	Leaf rolling mosaic
Mosaic dwarf	Severe mosaic	Mottled mosaic
Mild mosaic	Rugose mosaic	Spindle tuber
Mottled curly dwarf	Curly dwarf	Marginal leafroll
Calico	Giant hills	Crinkle
Leaf drop	Russet dwarf	Streak
Stipple streak	Spindle sprout	

In connection with mosaic, Miss Patch raises the question whether or not some of the other 21 sucking insects found on potatoes do not carry the inoculum as well as do the aphids. It has been observed that mosaic spreads when no aphids are present.

Newhall has found that lettuce mosaic is carried in the seed and is transmitted by means of potato aphids. In many other hosts the mosaic is seed-borne. The question arises as to whether the way in which the seeds are attached to the mother plant has a bearing on mosaic transmission.

Varietal susceptibility notes

Dr. H. E. Thomas at Ithaca, New York, inspected 54 varieties of celery in the vegetable gardens and found that all of them were about equally susceptible to late blight.

Newhall reports that the Los Angeles variety of lettuce was so susceptible to mildew that it was not profitable in New York.

Table 3. Resistant varieties of vegetables and other crops which were mentioned in Survey reports.

Crop	Place	Disease	Resistant variety
Asparagus	Boston	Rust	Martha and Mary Washington
Beans	New York	Anthracnose	Well's Red Kidney
Beans	Michigan	Mosaic	Michigan Robust Pea
Beans	New York	Root rot	Breeding work being done
Beans	New York	Bacterial blight	" " " "
Cabbage	Wisconsin	Yellows	Strains of various types
Celery	Michigan	Yellows	Strains of Gold. S. Blanch.
Lettuce	New York	Bottom rot	Long stemmed Boston head
Potato	New York	Late blight	Ekishirazu
Potato	Pennsylvania et al	Wart	Many varieties
Spinach	Virginia	Mosaic	Virginia Savoy

Crop	Place	Disease	Resistant variety
Sugar cane	Argentina	Mosaic	Kavangire
Sweet potato	New Jersey et al	Stem rot	Triumph
Tobacco	Kentucky	Root rot	Strain of White Burley
Tomato	U. S. D. A.	Wilt	Norduke, Norton, Marvel, Columbia, Arlington.
Tomato	Louisiana	Wilt	Red, Louisiana Pink
Tomato	Tennessee	Wilt	A 16-2

Progress in the development of control measures

Soft rots of vegetables:

According to a Pennsylvania bulletin, Sclerotinia libertiana will die in the soil in two years if no susceptible crop is grown.

Bacillus carotovorus seldom attacks carrots in the growing stages, according to a report from New Jersey. Carrots are attacked only when left in the ground too long. They should be harvested as soon as possible.

Soil and seed treatment:

Osmun and Anderson, of Massachusetts, have developed a new type of tank for regulating the flow of formaldehyde when it is applied for the control of onion smut. The top of the tank is air-tight, the air being admitted near the base of the tank from a pipe which extends parallel with the tank and which is as tall as the latter. They have also prepared various sized discs which will determine the rate of flow of formaldehyde and may be regulated according to the speed with which the farmer walks.

Favorable results in the use of inoculated sulphur for the control of potato scab have again been reported from New Jersey. Other states report variable results. Evidently difference in soil, climate, and other environmental factors have a bearing upon the application of sulphur. The control of Cystospora batata of sweet potato has also been accomplished in other states by the use of 300-400 pounds of inoculated sulphur applied just previously to the making up of the ridges. Sulphur has also been used in Kentucky in the preserving of cut potato seed. The results were so satisfactory that a large amount was ordered for this coming season's crop.

Martin, of New Jersey, used sulphate of ammonia as compared with nitrate of soda in the control of scab. The former gave very satisfactory results.

Walker, of Wisconsin, has found that treating cabbage seed at 50° C. for 30 minutes will eliminate the black leg organism from the seed. This is a very drastic treatment, but will mean a saving of thousands of dollars for the seed growers who are making heroic attempts at getting clean seed. A number of seed growers are also treating their seed with hot water 55° C. for 10 minutes. This controls black rot, most of the black leg, and also eliminates the Alternaria which the corrosive sublimate does not do.

Mosaic control:

Gardner, of Indiana, has shown quite conclusively that when the solanaceous weeds, such as ground cherry and horse nettle, are eradicated and care taken that no old tomato plants are left in greenhouses where seedlings are grown, tomato mosaic can be almost entirely eliminated.

Potato tuber indexing:

Perry, Blodgett and Fernow, of New York State, have done much work with indexing potato tubers for the elimination of degeneration diseases. This seems to be the only method remaining which will furnish a source of clean seed which may be used for the growing of certified stock.

Dusting:

The question of using dust instead of spray has been raised quite generally, especially since dust is so convenient to apply and appeals so strongly to the average grower. Quite variable results have been obtained in different states. Dye and Newhall, in New York, obtained almost perfect results when dusting celery; while Poole, in New Jersey, reports dust as worthless. The control of Alternaria of cantaloupe was only fair with dust. Cardinell and Page, in Missouri, report excellent control in the use of dust of watermelon anthracnose. Out of 150 rows 32 were treated,- 80% of the melons were picked from these 32 rows. Martin, in New Jersey, had much better control with Bordeaux. Martin also obtained very beneficial results when using calcium caseinate. Anderson, in Massachusetts, was able by spraying or dusting to control tobacco wildfire in the seed beds. Checks showed up to 92% disease, while the dusted showed not over 1%.

Sweet potato certification:

A number of plant pathologists and others interested in sweet potato growing met in a conference at Atlanta, Georgia. At that time they drew up certain resolutions which suggested that a voluntary certification system be planned in each of the sweet potato states, and that at least two inspections be made. Following are the states which have reported a sweet potato certification program: New Jersey, Maryland, Tennessee, South Carolina, Georgia, Florida, Alabama, Mississippi, and Arkansas. Louisiana and Texas say they have no such work started yet. In nearly all cases the work is based on that which was begun in Arkansas. Three inspections are made.

POTATO

Seed Certification

Seed certification is being practiced more widely each year, according to A. G. Tolaas, who gave a summary of the work in 1922. (Potato Assoc. Amer. Boston meeting.)

In addition to the table given below, Valleau makes the following report of potatoes grown late in the summer for seed in Kentucky:

Jefferson County - 47 applications - 150 acres - Passing all inspections
25 applications - 80 acres - 2420 bushels for sale
Shelby County - Passing all inspections - 2 applications - 11 acres - 735 bushels for sale.

The following quotation taken from the Clip Sheet (No. 204, May 22, 1922) of the Department of Agriculture indicates somewhat the extent to which certified seed is planted and the beneficial results from its use in Louisiana:

> "This year 22 carloads of certified seed potatoes, all of the Triumph variety, were planted in Louisiana alone. Twelve carloads came from Wisconsin and 10 from western Nebraska. It is claimed that by the use of this high-grade seed the yields

in that State are being increased 40 bushels or more an acre over that of much of the seed formerly sold there."

(For a more detailed discussion of seed certification, see Plant Disease Bulletin Supplement 22: 257-262. 1922.)

Table 4. Summary of potato seed certification in the United States and Canada in 1922. Data given by A. G. Tolaas, at the Boston Meeting of the Potato Association of America.

Place	Men or agencies handling inspection	Applications	Acreage	Certified: No. fields	Certified: Acreage	Certified: Bushels	Certified: No. inspections
Brit. Col.	Dept. Agr.	135	180	170	105	10,000	4
Alberta and Saskatchewan	University of Saskatchewan	100	1,500	100	300	2,000	
New Bruns.	Dom. Expt. Farms	520	4,000	130	1,325		
P. E. I.	Dept. Agr.	450	3,000	530	2,300	130,000	
Canada	Div. Bot., Dept. Agr.	1,219	11,250	1,732	6,642	299,665	4
Maine	Sta. Dept. Agr.	240	2,802	75	1,189	297,250	3
Vt.	Sta. Dept. Agr.	277	1,100	96	588	125,000	3
New York	Col. Agr., Dept. Pl. Path.	208	1,803		1,132	256,127	3
New Jersey	Sta. Potato Assn.	103	762	52	288	46,120	3
Penna.	Bu. Pl. Ind.	187	988	85	316	67,827	5
Mich.	Mich. Potato Producers' Assn.	532	3,196	420	2,429	315,758	4
Wis.	Hort. Dept.	560	4,225	325	2,000	400,000	5
Minn.	Sta. Dept. Agr.	441	3,530	330	2,671	338,100	4
N. Dak.	Sta. Seed Com.	833	8,615				2
Nebr.	Dept. Hort.	298	4,500	120	1,800	84,000	4
Colo.	Sta. Horticulturist	110	800	41	500	84,000	3
Mont.	Hort. Dept.	208	975		175		2
	Flathead County Potato Improvement Association	38	301	14	143	5,720	6
Utah	Sta. Bd. Agr.	25	75		17	2,000	2
Idaho	Com. of Pure Seed	798	4,086	190	1,464		3
Wash.	Sta. Dept. Agr.	188	1,210	39	216	26,600	4
Ore.	Agr. Coll.	290	2,992	51	550	10,000	3
Calif.	Sta. Dept. Agr.	40	1,534	34	1,384	100,000	3
Total		7,800	63,424	4,534	27,534	2,600,167	

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Tolaas, A. G. Minnesota potato certification rules. Pot. Mag. 49: 10-18. 1922.

Late blight caused by Phytophthora infestans (Mont.) De Bary

Late blight, although severe in New England and New York in 1922, was much less destructive than in the seasons of 1919 and 1920. In these years the average losses in eight states where blight was of great importance were 18 and 20%, respectively, while in 1922 the corresponding loss was only 8%. In 1921 there was almost no injury due to Phytophthora infestans. During the present season the disease was reported from all the states along the Atlantic Coast from Florida to Maine and along the northern tier of states as far west as Wisconsin. There was only a trace in northwestern Washington. In the East the heavy rainfall in June and first part of July caused such early infections that a large percentage of loss was due to the killing of the vines, rather than the rotting of the tubers.

Table 5. Percentage loss from potato late blight in states where losses were heavy.

State	Prevalence compared with Last Year	Prevalence compared with Average Year	Percentage loss	Range within State
Maine	-	-	5 or less	General
New Hampshire	More	More	15	General
Vermont	More	More	15-25	General, except Lake Champlain Valley
Massachusetts	More	More	10	General
Connecticut	More	More	6	General
New York	More	More	5-10	General
New Jersey	More	More	2.5	North and central part
Pennsylvania	-	-	5	Northern tier of counties especially
Maryland	Less	Less	2-3	
West Virginia	-	-	t	Central section
Georgia	-	-	1	
Tennessee	-	-	5	
South Carolina	-	-	2	
Michigan	-	-	1-3	Upper Peninsula
Wisconsin	-	Same	t	Widely scattered

Other states reporting the disease were Delaware, Florida, Ohio and Washington.

The following states reported that no late blight was observed: Mississippi, Illinois, Minnesota, Indiana, Iowa, North Dakota, South Dakota, Kentucky, Louisiana, Arkansas, Idaho and Oregon. Prof. Bolley of North Dakota writes further that "North Dakota has never experienced any attack of the so-called late blight. I have never in my life here in the state seen more than one case of late blight."

Table 6. Dates of earliest appearance of late blight in the United States in 1922, according to collaborators.

Date	Place	Date	Place
May 23	Martin's Point, So. Car.	June 23	Monmouth County, New Jersey
June 18	Nassau County, New York	July 2	Tucker County, West Virginia

Date	Place	Date	Place
July 7	New Durham, New Hampshire	July 25	Amherst, Massachusetts
July 7	Milford, Connecticut	July 28	Maryland
July 17	Wayne County, Pennsylvania	August 4	Oceana County, Michigan
July 18	Rutland County, Vermont	August 14	Blacksburg, Virginia
July 20	Colby, Wisconsin		

The following extract from a recent paper by Donald Reddick (1) indicates that there are possibilities of securing late blight resistant varieties:

> "The potato variety Ekishirazu has been tested in greenhouse and field at Ithaca, New York. In a cool house it grows luxuriantly and produces large tubers. In a warm house it makes very poor growth and produces many small tubers. Both in 1921 and 1922 its growth in the field corresponded to that of the warm house. The variety has been subjected repeatedly, both under glass and out of doors, to extremely favorable conditions for infection by Phytophthora infestans. Occasional small lesions have been produced but conidiophores on lesions of attached leaves have been found only once."

It has long been known that rainfall and humidity have a very important bearing on the amount of late blight on potatoes. This fact is again confirmed for the present season. In northern New York and along Lake Champlain Valley in Vermont the blight was reported as very slight. Similarly the southern part of Michigan was comparatively free from the disease, while fields in the northern part were more severely affected. A glance at the Map (Fig. 1) showing the precipitation for July when most primary infections are reported, will show that the areas where blight was unimportant received less rainfall than the remaining sections.

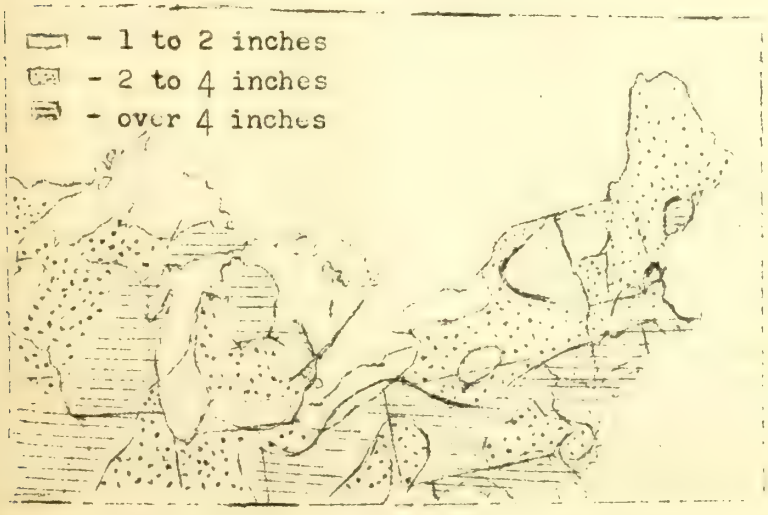

Fig. 1. Precipitation map for July, 1922. From Monthly Weather Review.

The question arises concerning other factors that may influence the growth and development of Phytophthora infestans. It has already been shown by Melhus that the conidia germinate best at temperatures ranging from 5-13° C. (41-54°F.). Probably the New England States, New York and northern Michigan always have a minimum temperature, especially at night, which gives optimum conditions for germination. This is followed by warm humid days permitting the mycelium to progress in the leaf. Farther south, however, this low temperature may not always prevail.

Table 7. Mean monthly minimum temperatures for different parts of Pennsylvania, Ohio and Michigan during the months of July and August, 1922. (Monthly Weather Review)

Place	Mean Minimum Temperature (°F)		Place	Mean Minimum Temperature (°F)	
	July	August		July	August
Pennsylvania:			Michigan:		
Philadelphia (south)	58	56	Ludington	46	45
Harrisburg (south)	58	55	Saginaw	45	47
Reading (south)	58	54			
Scranton (north)	49	49	Ohio:		
			Dayton	51	52
Michigan:			Cleveland	52	51
Sault St. Marie	42	40	Sandusky	54	53

Above is a table giving the minimum temperatures of different parts of Pennsylvania during the months of July and August, as well as comparing those of Ohio and Michigan. Ohio had as much rainfall as Michigan, but late blight was not present in the former. Central Pennsylvania, likewise, had as much rainfall as its northern tier of counties, but late blight was reported from the latter. The tabulation is not given as facts which have been definitely established but rather as a possible suggestion, since the temperatures coincide so nearly with those which Melhus found were optimum for Phytophthora infestans.

Late blight control

New Jersey: "In a spraying test on commercial crop, American Giants in Monmouth County, home made Bordeaux mixture gave an increase of 69 bushels per acre as compared with 26 bushels for a commercial Bordeaux. Practically all of the increase is attributed to late blight control."

Treatment	Dead leaves Aug. 2 Per cent	Bu. per acre	Difference
Check (unsprayed)	92	280.9	--
5-5-50 Bordeaux mixture (3 applications)	77	271.8	-9.1
Bordeaux mixture (7 applications)	5	350.3	69.4
Commercial Bordeaux (7 applications)	24	307.4	26.5
Commercial Bordeaux (dust)	72	301.1	20.2
Copper-lime (3 applications)	91	300.7	19.8
Copper-lime (7 applications)	70	263.7	-20.2

"Included in this test were three plots sprayed with a home made Bordeaux mixture (5-5-50) plus 3/4 lb. of calcium caseinate to 100 gallons. In every case the yield of the plots sprayed with the material was greater than that of plots sprayed with Bordeaux mixture above." (W. H. Martin.)

Michigan: "It is evident that Bordeaux mixture is far superior to Bordeaux-like dusts, and that its application brings high returns in increased yields." (Coons and Kotila)

Recent literature

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Bruyn, Helena, L. G. The saprophytic life of Phytophthora in the soil. Mededeelingen van de Landbouwhoogeschool. 24: 1-37. 1922.

Has cultivated P. infestans on soil in laboratory. Has cultures on clay 11 months old and fungus still viable and pathogenic.

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Kotila, J. E. and G. H. Coons. Spraying and dusting of potatoes in 1922 at Chatham, Michigan. (Abstract) Phytopath. 13: 54. 1923.

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Murphy, P. A. The bionomics of the conidia of Phytophthora infestans (Mont.) de Bary. Sci. Proc. Roy. Dublin Soc. n.s., 16: 442-466. Feb. 1922.

"Conidia of Phytophthora infestans when mingled with soil and kept out of doors may remain viable and capable of infecting potato tubers for a period of between three and four weeks."

Pennington, S., and H. G. Robinson. Spraying of potatoes for "blight" or "potato disease" (Phytophthora infestans). Bul. Univ. Col. Reading 30: 1-8. 1921.

Pethybridge, G. H. Some recent work on the potato blight. Rept. Int. Potato Conf. Roy. Hort. Soc. (England) 112: 126. 1921.

"The role of resting spores in the life cycle under field conditions remains unknown, but there is some evidence that they exist and are responsible for some otherwise unexplainable outbreaks of blight."

Early blight caused by Macrosporium solani E. & M.

Early blight of potatoes was present in nearly every state, but caused relatively slight injury. Comments from different states on prevalence of the disease are as follows:

Maine: Very severe in certain fields near Corinna. (F. Weiss)

New Hampshire: More than usually prevalent, many fields prematurely killed. (Butler)

Delaware: Very prevalent throughout state. Heavy rains associated with its severe prevalence on early crop. (Adams)

Kentucky: The occurrence of early blight is spotted. Some sections entirely swept as early as September 25; in others, no more than 20% at killing frost. (J. S. Gardner)

Georgia: Well distributed in state, causing considerable loss. (McHatton)

Ohio: Very little of this disease is to be found in northern Ohio, yet is general in the southern portion of the state. (Thomas)

Illinois: Occurring throughout the state, and causing serious losses in some instances. Our most common and most destructive potato disease. (Tehon)

Michigan: Exceptionally prevalent, beginning in the early part of September and causing shortening of crop. Sprayed fields, unless spraying continued late in September, showed blight. Loss less than 1921. (Bot. Exp. Sta. Mich. Agr. Coll., October 15)

Minnesota: Heavy infections reported from the northern part of the state and the Red River Valley. (Section of Plant Pathology)

North Dakota: Distinct target board lesions have been found in several fields this year, and I think it is safe to say that the disease is much more common than in previous years. Spraying with Bordeaux has not been commonly practiced. (Weniger)

Utah: Early blight is becoming a rather serious factor in certain areas in the state. In Cache County a number of fields showed this in such a severe form that plants were killed three weeks earlier than death normally occurs. (Richards)

Oregon: Not reported even from the Coast section this year. If present (as probable) is negligible in the state. (Barss)

Table 8. Percentage loss from, and geographic range of, early blight as reported to the Plant Disease Survey, 1922.

State	Prevalence compared with Last Year	Prevalence compared with Average Year	Percentage loss	Geographic range
Maine	-	-		Present
New Hampshire	-	More		Southern half of state
Vermont	-	More	2-5	General
Massachusetts	-	Less	t	"
Connecticut	More	More	2	
New York	Same	Same	t	"
Pennsylvania	-	-	1	
New Jersey	Less	Less	t	"
Delaware	More	Same	1.5	"
Maryland	Same	Same	.5	Eastern part of state
Virginia	-	-	1	
West Virginia	-	-	t	General

State	Prevalence compared with: Last Year	Average Year	Percentage loss	Geographic range
Kentucky	Less	Less	15 (fall crop)	
South Carolina	-	-	Unimportant	General
Georgia	More	-	1	"
Mississippi	Less	Less	1	"
Louisiana	-	-	t	
Texas	-	-	Unimportant	
Arkansas	-	-	0	
Ohio	-	-	Slight	General in southern section
Indiana	-	-	Not serious	
Illinois	Same	Same	1	
Michigan	More	Less		
Wisconsin	Less	Less	t	General
Minnesota	More	Same	Not serious	
Iowa			Unimportant	
North Dakota	More	More	.5	Eastern half of state
South Dakota			t	
Kansas			.5	
Colorado	-	Same		
Arizona	-	-	Common	
Utah	-	-	.5	
Idaho	Same	-	t	
Oregon	-	-		Present
Washington	-	-	0	

Table 9. Dates of earliest recorded appearance of early blight, 1922.

Date	Place	Date	Place
May 1	John's Island, South Carolina	July 9	Ipswich, South Dakota
May (last of)	Kansas	July 21	New Castle County, Delaware
May 7	Holmes County, Mississippi	July 22	Webster, North Dakota
June 8	St. Clair County, Michigan	July	St. Johnsburg, Vermont
June 10	Salem County, New Jersey	July	Nassau County, New York
July 1	Derry, New Hampshire	Aug. 1	Starks, Wisconsin
July 5	Isanti County, Minnesota	Sept. 1	Kentucky
July 7	Milford, Connecticut		

Comments on susceptibility of varieties:

Connecticut: Most on early varieties.

Kentucky: The early planted Cobblers suffered worst. A strain of Cobbler, grown by Jacob Klingenfuss, Jeffersontown later in maturing and a decidedly heavier yielder than the majority of Cobbler strains in Jefferson County, takes the blight so late as to almost justify its reputation as being "blight proof." (J. S. Gardner)

Wisconsin: Scattering infection in many fields of Green Mountain and Early Ohio. None seen on Rural New Yorker. (Vaughan)

Minnesota: In two neighboring fields very heavy infection was observed on Bliss Triumphs but very little on Ohios.

Control measures:

New York: Early blight is harder to control either by spraying or dusting than late blight. (Chupp)
Long Island. Quite prevalent and very little control from spraying. Am becoming convinced that our ordinary potato spray procedure is ineffectual against the disease. (E. E. Clayton)

New Jersey: Early blight was abundant on the late crop planted for seed. A spray test was conducted at Elmer where a comparison was made of home made Bordeaux mixture prepared with stone lime and with hydrated lime, also with and without a casein spreader. An examination of the plots on Oct. 18 showed dead leaves to be present on the various plots as follows: Check 52%, hydrated lime 5%, Stone lime 0, Stone lime and spreader 0. On the last two treatments no early blight was found, there was considerable on the plots sprayed with the hydrated lime Bordeaux, and the check plots were heavily infected. The yield of the various plots follow: Check 150.6, hydrated lime 156.2, Stone lime 167.1, Stone lime and spreader 164.8. The small differences in yield may be accounted for on the ground that the season was very dry and the crop was killed by frost early in its development. (W. H. Martin)

Kentucky: Spraying potatoes (fall crop) with 5-5-50 either with traction or engine power has resulted in about 25% increase in yield in several cases. This is probably due nearly entirely to control of early blight late in the fall while tubers are making most rapid growth. (Valleau & Gardner)

Four applications were made of Bordeaux calcium arsenate dust on four acres of fall potatoes at a cost of $12 per cwt. of dust. The four acres dusted averaged 30 bushels per acre more than undusted which was about 135 bushels per acre. (Gardner)

Kansas: Control by spraying and dusting gave inconclusive data. (R. P. White)

Arizona: Bordeaux spray excellent where three applications were made.

Fusarium wilt caused by Fusarium oxysporum Schlecht.

Fusarium wilt evidently is present in nearly every state where potatoes are grown commercially, although none of the collaborators report heavy losses. In none of the states was the disease general, the Fusarium being limited to certain areas.

Table 10. Losses due to Fusarium wilt, according to collaborators, 1922.

State	% loss	State	% loss	State	% loss	State	% loss
Massachusetts	Trace	South Carolina	Trace	Ohio	5	Iowa	6
New York	1.5	Kentucky	1	Indiana	.5	N. Dak.	2

State	% loss	State	% loss	State	% loss	State	% loss
Pennsylvania	5	Mississippi	1	Wisconsin	0	Utah	3.5
Maryland	.5	Texas	1	Minnesota	.5	Idaho	1
		Arkansas	t			Washington	t

Other states from which the disease was reported are New Jersey, Florida, Michigan, Missouri, South Dakota, Kansas, Montana and Colorado.

Both the seed tubers and the soil are sources of infection for the new crop. According to the reports given below the organism is very commonly present in the soil:

Missouri: That infection is mostly soil-borne is indicated by the fact that most of this disease occurred where potatoes had been grown 2 to 15 years previously. (Maneval)

Kansas: Kansas potato soils are apparently heavily infested with this organism, for Kansas potatoes, if stored, show high percents (80% approx.) of internal vascular browning, from which F. oxysporum can readily be isolated. No case of wilt in the fields has been noticed, however, due probably to some ecologic factor. (R. P. White)

Very little is reported regarding the ecological influences upon the severity of the disease. It is generally considered that high temperatures determine in a great measure the amount of injury produced. The following reports uphold this statement:

New York: Occurs wherever potatoes are grown, but most serious in Hudson Valley. Soil infestation and warmth of the weather are more important than the fact that the seed is infected. (Chupp)

Pennsylvania: Eastern part of state. Worse on limestone soils and following Rhizoctonia. (Nixon)

Michigan: Common in northern part of state; whole fields dying early. Believed to be correlated with high soil temperatures. (Bot. Exp. Sta., Mich. Agr. Coll.)

The following quotation by Miss Wanda Weniger (1) of North Dakota, is interesting:

> "During the past three years cultural studies of stem-end discolored tubers from nearly every potato growing section of the state have been made with a view of determining the cause and nature of vascular discolorations. The tubers studied were mostly of the Early Ohio variety, all showing a distinct browning of the vascular tissues when cut across about one-fourth to three-eighths of an inch from the point of rhizome attachment. Cultures were made from tissue taken at an average depth of one-half inch from the point of attachment and at least three made from each tuber. Fusarium

wilt was found associated with less than one-half of the discolorations, and was not as is popular belief, the sole cause of discolorations. Many tubers, although showing a distinct browning, gave no growth of any parasitic organism, while others showing little browning gave the Fusarium wilt fungus. In a large percentage of tubers the blackleg bacillus was found, while in some both blackleg and wilt were present. These discolorations, whether yielding growths of Fusarium wilt, of blackleg, of both wilt and blackleg, or of no organism, were not distinguishable either in color or extent."

Table 11. Dates of earliest appearance of Fusarium wilt in the United States in 1922.

Date	Place	Date	Place
May 1	John's Island, South Carolina	July 7	Floyd County, Indiana
May 6	Gulfport, Mississippi	July 14	Sullivan County, New York
June 6	Carroll County, Ohio	July 20	Becker County, Minnesota
June 19	Missouri City, Missouri	July	Brookings, South Dakota
June 20	Hightstown, New Jersey		

Varietal Susceptibility

Although no variety of potatoes has been found immune, or even distinctly resistant to Fusarium wilt, there are certain occasions when one variety will show less disease than another variety planted under similar conditions. Following are two reports concerning this:

Kentucky: Some strains of Cobbler show as much as 3% of Fusarium wilt. Generally less than 1% in selected stocks. (J. S. Gardner)

Georgia: This disease has been reported from many counties and seems to be especially prevalent on the Red Bliss and Early Rose potato. The Irish Cobbler seems to be the most resistant variety. (J.H. Miller)

Control Measures

According to Miss Wanda Weniger, in North Dakota best control was obtained by selection of seed tubers, cutting the stem ends.

References

(Cited)

1.Weniger, Wanda. Studies on the causes of stem-end discolorations of potato tubers in North Dakota. Phytopath. 13: 55. 1923.

(Not cited)

Dickson, B. T. Diseases of the potato. Scient. Agr. 2: 310-312, 325-327. May 1922.

Goss, R. W. Temperature and humidity studies of some Fusaria rots of the Irish potato. Jour. Agr. Res. 22: 65-79. 1922.

"Fusarium oxysporum, F. tricothecioides, F. radicicola were used in inoculation experiments at controlled temperatures and humidities. At 25° C. all produced more or

less rotting, the rapidity varying with the humidity. At lower temperatures humidity was the controlling factor in producing rot. Old tubers are most susceptible."

McKay, M. B. Transmission of some wilt diseases in seed potatoes. Jour. Agr. Res. 21: 341-348. 1921.

Mann, H. H. and S. D. Nagpurkar. Further investigations on the Fusarium blights of potatoes in western India. Agr. Jour. India 17: 564-576. November 1922.

Soil remains very infective after three months and six months. After nine months attack is very much less.

Botany and Plant Pathology. Fusarium wilt of potato. Pa. Sta. Bul. 170: 15-20. 1922.

"Studies of wilt of potatoes have shown that three species, Fusarium oxysporum, F. eumartii, and Verticillium sp., are involved in the wilt problem, and that most of the infection comes from the soil." (Abst. E.S.R. Oct. 1922)

Wart caused by Synchytrium endobioticum (Schilb.) Percival

Very little additional information regarding the spread of wart has been obtained. The disease has been surveyed so closely that few, if any, evident infested areas remain unknown. For the detailed report of the geographic distribution of this disease, the reader is referred to the Plant Disease Survey Bulletin Supplement 16: 190-193. 1921 and Supplement 22: 279-284. 1922. In addition to the infested areas mentioned previously may be included the localities given in a report from Maryland:

"Wart was found in six new gardens, five of which were located at Lord and one at Eckhart Mines. No cases found outside of quarantined areas." (Temple & Jehle, Sept. 1) (See Pl. Dis. Bul. 6: 69. Aug. 15, 1922 for map of quarantined areas.)

The danger of having the fungus spread is well expressed in the following quotation (from U. S. Dept. Official Record 1[28]: 3. July 12, 1922):

"Studies of this problem, which have been carried on for two years and are now nearing completion, indicate that the fungus causing wart disease is so closely adapted a parasite that the environment which most favors its host is best for its own development also.

"A comparison of weather records for the eastern Pennsylvania infested area with those of the principal potato sections of the United States shows that in respect to rainfall and temperature conditions during the growing season for late potatoes the wart-infested areas are in no way unique; nor are potatoes successfully grown in any region where the climate ordinarily is warmer and drier than was the season of 1921 in eastern Pennsylvania, where wart developed only slightly less severely than usual.

"It seems likely that wart disease might gain a foothold even in our early potato districts."

References

Anon. Wart disease attacking the tomato. Gard. Chron. III, 71: 62. Feb. 11, 1922.

Anon. Wart disease of potatoes immunity trials. Gard. Chron. III, 72: 229. Oct. 14, 1922.

"It was found that selfed immune varieties produced a large number of immune seedlings, and that in many respects these reproduced the characteristics of the parents, and that in a few cases..... they were indistinguishable from the parents, and showed a high percentage of immune individuals."

Blackman, V. H. The nature of immunity from wart disease. Rept. Internat. Potato Conference. p. 92. Roy. Hort. Soc.: London, 1921 (1922).

".....as yet there is no certain knowledge as to whether resistance depends on anatomical or physiological factors."

Brierly, William B. Some research aspects of the wart disease problem. Rept. Internat. Potato Conference. p. 93-104. Roy. Hort. Soc.: London, 1921 (1922).

"Immune varieties, stability of host and of fungous parasite, nature of immunity to disease, relation between disease and external factors, and soil sterilization are discussed in relation to the wart disease."

Botany and Plant Pathology. Potato Wart. Penn. Sta. Bul. 170: 15-19, 19-20. 1922.

Botjes, J. Cortwijn, and H. M. Quanjer. Dutch potato varieties resistant to wart disease and internal brown spot. (Abstract) Phytopath. 13: 54. 1923.

Cuthbertson, William. The problem of immunity to wart disease in potatoes. Gard. Chron. III, 71: 104. March 4, 1922.

Dickson, B. T. Diseases of the potato. Scient. Agr. 2: 202-206. Feb. 1922.

de Toit, P. J. Annual report of the secretary for agriculture, year ended 30th June, 1922. Jour. Dept. Agr. South Africa 5: 480-517. Dec. 1922.

"This disease was unfortunately discovered in Natal and its origin has not yet been traced. So far the disease has been found on two adjoining farms in the Impendhle Division. The Department has been enforcing for years stringent regulations against the introduction of this serious disease, which is prevalent in several countries of Europe. Careful inspection was immediately instituted by the Division of Botany as to likely sources of infection, but without success. Careful watch is being kept over the principal markets of Natal for infected tubers. The infected properties have, of course been quarantined and other necessary restrictive measures taken."

Doidge, E. M. Wart disease of potatoes: Synchytrium endobioticum Perc. Jour. Dept. Agr. So. Africa 4: 447-451. illus. May 1922.

"In spite of quarantine, wart has been found in at least one locality in the Impendhle Division, Natal."

Esmarch, F. Der kartoffelkrebs, eine ernste gefahr fur den sachsischen kartoffelbau. Sach. Landw. Zeitschr. 70: 498-499. Oct. 28, 1922.

Foëx, E. La maladie verruqueuse de la pomme de terre ou galle noire. Jour. Agr. Prat. 149: 174-177. Aug. 26, 1922.

Oberstein, Otto. Beitrag zur prüfung von kartoffelsorten auf ihre widerstandsfähigkeit gegen dem kartoffelkrebs. Angew. Bot. 4: 72-74. March-April 1922.

Protzen, Karl. Die krebsfrage in physiologischer beleuchtung. Deutsche Obstbauz. 68: 62-73. Feb. 1922.

Salaman, R. N. and J. W. Lesley. Some information on the heredity of immunity from wart disease. Rept. Internat. Potato Conference. p. 105-111. Roy. Hort. Soc.: London, 1921 (1922).

Schaffnit, Ernst. Der kartoffelkrebs. Deutsche Obstbauz. 68: 212-213. June 1922.

Scotland Board of Agriculture. Testing of new varieties of the potato for immunity from wart disease. Scott. Jour. Agr. 5: 306-311. July 1922.

Spagnier, Henry. La galle verruqueuse des pommes de terre Jour. Agr. Prat. 86: 476-478. Dec. 9, 1922.

Spieckermann, Albert. Wie kann die weitere verbreitung des kartoffelkrebses in Deutschland verhindert werden? Landw. Zeit. 42: 371-372. Nov. 18, 1922.

Wart continues to spread in Germany. Is now known to occur on some potato farms, and a four-year rotation does not check it.

Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston meeting. 1922.

Trabut, Louis. La gale noire de pomme de terre ou maladie verruqueuse. Bull. Agr. Algerie-Tun.-Maroc. II, 28: 58-61. Feb. 1922.

Weiss, Freeman and C. R. Orton. Progress notes on potato wart disease investigations. (Abstract) Phytopath. 12: 38. 1922.

Leaf roll or mosaic does not affect immunity to wart disease.

Stem rot and scurf caused by Corticium vagum DC.

No disease is reported more often than Rhizoctonia, and in a large number of cases it is considered one of the serious troubles of potatoes. Space can be given only to a few of the typical reports regarding the injury and distribution of the disease.

Virginia: Rhizoctonia caused considerable trouble on the higher lands. This disease affected the germination and thereby reduced the yield of the crop. (T. C. Johnson, July 24)

Kentucky: Fall crop starting in hot weather not affected. The fact that the scurf is not found on Kentucky grown tubers most years indicates that infection in the spring crop probably comes from soil. (Valleau & Gardner)

North Dakota: Very abundant this year, being found in fields from untreated seed, improperly treated seed, and also from infected soil. The percentage of infected vines in fields is from 5-30. There is much evidence of dying off of sprouts while still underground. Dry stem rot and little potato have been abundantly observed. (Weniger)

South Dakota: Seems to be very prevalent; mostly late infection with some early deep pitted damage. (Evans)

Kansas: Everywhere potato is grown. Most important disease. (White)

Nebraska: Heavy infection early in season causing considerable killing of sprouts. One field 100 acres, 75% infected when plants 3" high. (Goss)

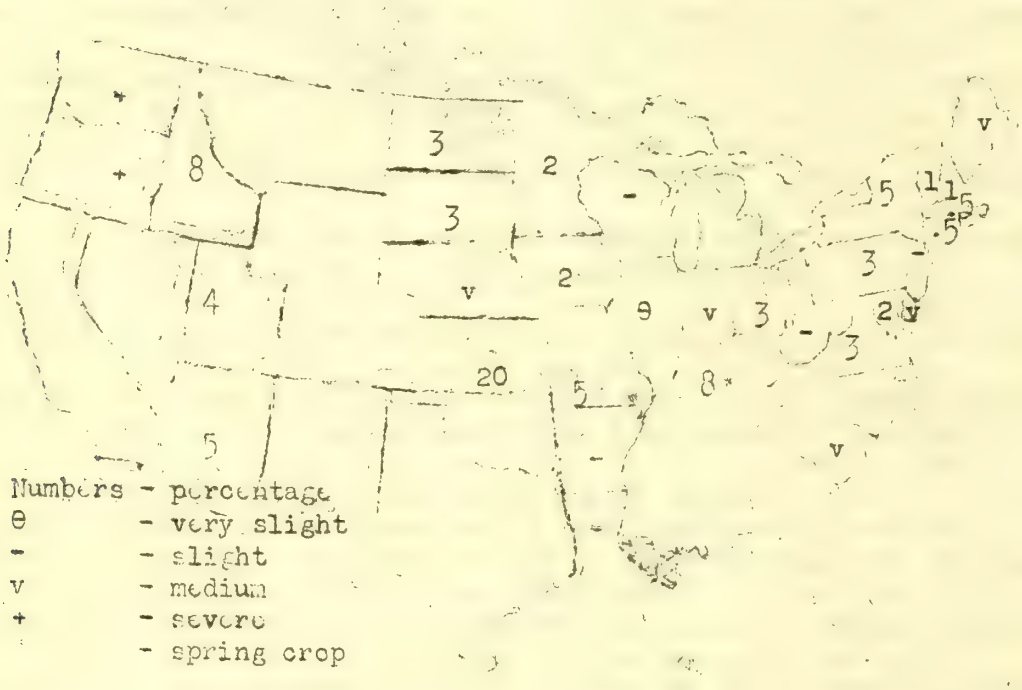

Fig. 2. Severity of, and estimated percentage losses from Rhizoctonia, 1922.

The amount of rainfall and the type of soil have an effect upon the seriousness of the disease, according to the reports from New Hampshire and Minnesota. The report from the latter state is of special interest since Wollenweber (Der kartoffelschorf. Arbeiten des Forschungsinstitutes für Kartoffelbau 2: 1-102. 1920. See 35.) argues that the fungus in soil rich with humus lives on the dead vegetable matter instead of on the potato plant. He states further that Rhizoctonia thrives best in acid soils, and can be held partly in check by the addition of lime to the soil.

New Hampshire: Poor stand in heavy soils due in part to attacks by black scurf. We had long continued and very wet weather following planting. (Butler)

Minnesota: General throughout the state, especially heavy on peat soil. (Section of Plant Pathology)

Table 12. Dates of earliest appearance of Rhizoctonia in the United States in 1922.

Date	Place	Date	Place
March 29	Pottawatomie, Kansas	May	Nassau County, New York
April	Louisiana	June 3	Hennepin County, Minnesota
May 1	John's Island, South Carolina	June 12	Champaign County, Ohio

Date	Place	Date	Place
June 18	Missouri	July 11	Wisconsin
June 23	Jefferson County, Illinois	July 20	Milford, Connecticut
June	South Dakota	September	New Castle County, Dela.
July 1	Kingston, New Hampshire		

In past seasons, different varieties have been named as being more susceptibile or more resistant to Rhizoctonia than others. In the reports of the present year nothing is said regarding varietal susceptibility. Seemingly no varieties are sufficiently resistant to attract special attention.

Control

The reports are unanimous in their statement that seed treatment was successful in the control of Rhizoctonia solani. There is a variation, however, in the methods which are applied. The cold corrosive sublimate solution is the most general disinfectant used. Hot formaldehyde appeals to those who have large quantities of tubers to treat. With the formaldehyde it is necessary to cover the tubers after dipping and this means that the potatoes must be handled twice. In order to avoid the double handling some experimental work has been done with hot corrosive sublimate, which has other advantages.

New York: Treatment with hot corrosive sublimate gave excellent results. (Chupp)

New Jersey: Seed disinfection with hot formaldehyde and cold corrosive sublimate gave very good control of Rhizoctonia. (W. H. Martin)

Ohio: Reports which come to us regarding this disease show that only fields where seed treatment was not employed are causing any concern. (Thomas)

Wisconsin: $HgCl_2$ treated seed showed little Rhizoctonia. Very successful this year. (Vaughan)

North Dakota: Best results in control by selection, treatment with corrosive sublimate, and rotation. (Weniger)

Kansas: Seed treatment on 3000 acres reduced loss. Average increase due to treatment by sublimate method for this and other disease 40 bu. per acre. (E. A. Stokdyk)

Arizona: Mercuric chloride used in Santa Cruz Valley and in Northern Arizona, with good results. (J. G. Brown)

Idaho: In order to thoroughly test out the hot formaldehyde method of potato seed treatment, a series of treatments were conducted in the laboratory. The following table gives the methods of treatment and results that were obtained in the field.

Table 13. Comparison of the efficiency of hot formaldehyde and corrosive sublimate in controlling Rhizoctonia in Idaho, 1922.

Treatment	Rhizoctonia		Clean		Per cent Rhizoctonia
	Marketable	Culls	Marketable	Culls	
	Lbs.	Lbs.	Lbs.	Lbs.	
1. Check	235	23	64	7.5	78.3
2. Formaldehyde 50° C., 3 min. sprinkled and covered 48 hours	63	3	322	24	16.01
3. Formaldehyde 50° C., 2 min. sprinkled and covered 48 hours	50	7.25	312.25	32	14.25
4. Mercuric Chloride	21	2.75	409.25	36	5.06
5. Mercuric Chloride sprinkled and covered 48 hours	67.25	7	300	28	18.45
6. Formaldehyde 50° C., 2 min.	146	16	217.75	33.75	39.17
7. Formaldehyde 50° C., 2 min. sprinkled	58	2.75	344	33.75	13.85
8. Check	278.25	23.5	41.5	16.5	77.34

Average yield of all treated plots 384.83 lbs.
Average yield of two check plots 309 lbs.

The discrepancy between treatments five and six is unaccounted for, as results of the previous season's work in the field showed that sprinkling the tubers previous to treatment increased the efficiency of the corrosive sublimate. This was also the case in the laboratory. (C. W. Hungerford)

Oregon: General throughout the state and serious but the more general adoption of corrosive sublimate for potato seed treatment is bringing about some reduction in the amount of damage done from year to year. (Barss)

In Canada the results of seed treatment were not so encouraging as in the United States, according to Bisby, Higham, and Groh (1).

"It will be seen from the following table that seed treatment had practically no influence on the amount of black scurf present; the limiting factor was the date of digging, as shown by the following list:

Dug	% black scurf	Dug	% black scurf
August 20	7.5	Sept. 6-7	88.5
" 26	54.0	" 8-9	94.4
" 30-31	56.3	Oct. 13	93.5
Sept. 1-2	70.8		

References:

(Cited)

1. Tisby, G. R., J. P. Higham, and H. Groh. Potato seed treatment tests in Manitoba. Scientific Agr. 3: 219-221. 1923.

(Not cited)

Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston Meeting. 1922.

"Rhizoctonia has been shown to be a cool weather parasite, causing severe damage to sprouts down to the lower temperature limit at which potatoes will grow.

The injury to sprouts, which is the most destructive form of this disease, does not occur at temperatures which are most favorable for rapid sprouting. This same fungus has been shown to be capable of producing a stem-end rot of elongated tubers which is jelly-like in the field and dry in storage."

Anon. Treating seed potatoes. Potato Magazine 4[7]: 10. 1922.

Howitt, J. E. Experiments in the control of Rhizoctonia or black scurf of potatoes. Sci. Agr. 1: 256. 1921.

"Treatment with solution of bichloride 1-500 for 2 hours gave perfect control; 1-1000 for same length of time reduced disfigured tubers to 14%."

Raeder, J. M. and Chas. W. Hungerford. The effect of presprinkling with water upon the efficiency of certain potato seed treatments for the control of Rhizoctonia. (Abstract) Phytopath. 12: 447-448. Sept. 1922.

"Preliminary laboratory tests conducted at the Idaho Experiment Station have shown that the efficiency of both the corrosive and hot formaldehyde treatments for seed potatoes is greatly increased by first sprinkling the potatoes with water and covering for either 24 or 48 hours."

Richards, B. L. Corticium vagum as a factor in potato production. (Abstract) Phytopath. 12: 444. Sept. 1922.

"Several strains of Corticium vagum were found to produce severe and characteristic cankers on all underground parts of the potato. All strains, though able to infect mature stems either with or without wounding, were found to attack the plant most vigorously in its earlier stages of development. Growing points of the young shoots and of the stolons proved especially susceptible to attack."

_____ Pathogenicity of Corticium vagum on the potato as affected by soil temperature. Jour. Agr. Res. 21: 459-482, pl. 88-93. 1921.

"There is no critical temperature for the pathogenicity of Rhizoctonia, as marked injury to sprouts occurred from 18° C. down to 12°. Above 21° this form of injury is slight and above 24° it disappears. Sprouting of tubers is most rapid about 24°; injury to sprouts by Rhizoctonia is in part dependent on cool temperature and slow growth rate during sprouting."

Shapovalov, Michael. Rhizoctonia solani as a potato-tuber rot fungus. Phytopath. 12: 334-336. July 1922. (August)

Common scab caused by Actinomyces scabies (Thax.) Güssow

Common scab, being caused by a soil organism is, as one would suppose, widespread and in many cases destructive. There was, however, no uniformity in the reports regarding it. The date of earliest appearance varied from May to the last of September; its prevalence compared with last year was much less in some states and much more in others, and the losses in individual cases ranged from nothing to one hundred percent.

Table 14. Comparative prevalence of scab and losses incurred in 1922.

State	Prevalence compared with: Last Year	Prevalence compared with: Average Year	% loss	State	Prevalence compared with: Last Year	Prevalence compared with: Average Year	% loss
Vermont	Less	Less	1-3	Arkansas	Less	Same	1
Massachusetts	Same	-		Ohio	Same	Same	
Connecticut	Same	-		Indiana	-	Same	
New York	Same	-	3	Illinois	Same	Same	t
New Jersey	Less	Same	5	Wisconsin	Less	Same	5
Delaware	Same	Same	.5	Minnesota	Same	Same	0.5
Maryland	More	More	3	Iowa	-	Less	
Virginia	More	-		North Dakota	-	Common	
West Virginia	Unimportant		t	South Dakota	-	More	5-10
Kentucky	More	More	-	Kansas	Same	Same	2
South Carolina	Unimportant		1	Idaho	-	Same	1
Georgia	-	Same		Colorado	Present	-	
Mississippi	-	Less		Arizona	Present		2
Texas	-	-	1				

Mississippi: Scab does not appear to be so widespread as in former years, and although but few growers treat seed potatoes for scab, the less frequent occurrence of the disease is partly attributed to the use of good seed in many parts of the state. Scattering reports have been received as to the disease being present, but damage is very slight. (Neal)

Indiana: Much soil infestation. Believe "russet scab" result of common scab infection (on Rurals). Evidence that organism persists six to seven years in soil obtained in Floyd and Allen Counties. (Gardner)

Minnesota: Very heavy infection reported from Kocchiching and Anoka Counties. Light infection from Beltrami. None in Red River Valley. (Section of Plant Pathology)

North Dakota: General. Especially pronounced on heavy soils of Red River Valley. (Weniger)

Kansas: Not of much importance unless tubers are harvested late. (Stokdyk)

There is a general opinion that Green Mountain and Cobblers are more susceptible than other varieties such as the American Giant and the Rural Russets.

(The American Giants in New York are usually resistant, but occasionally are badly scabbed. No cause has been assigned for the unexpected susceptibility - Chupp.)

"Certain German varieties are reported to possess so high a degree of scab resistance that they may safely be grown in neutral or alkaline soils." (Summary. Potato Association of America. Boston Meeting, 1922)

Wisconsin: Higher on Green Mountain and early varieties. (Vaughan)

New Jersey: American Giant variety less susceptible to scab than Irish Cobbler or Green Mountain. (W. H. Martin)

Control

In addition to the lack of uniformity in nearly every other part of the reports, the sections dealing with control were fully as conspicuous in their disagreement. Sulfur was used in a number of states with variable results. It must be borne in mind, however, that each demonstration differed from the others in type of soil, amount of rainfall, temperature, length of rotation, and other factors which possibly would alter conclusions.

"The relation between soil reaction and development of common scab has been found to hold for a number of localities and conditions and control of scab by rendering the soil acid is becoming a regular practice in some potato sections. The use of sulfur, either plain or inoculated, is the most general method of increasing soil acidity, but other methods, as the use of fertilizer salts, either normally acid in reaction or acidulated with sulfuric acid, is being successfully tried."
(Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston Meeting. 1922)

New York: (Nassau County) One potato scab demonstration, where sulphur was used as control, was completed. This demonstration was carefully arranged and exact data taken.

Inoculated Sulphur Plot (Texas Gulf)	Special inoculated
40.20% Clean	34.49% Clean
46.23% Salable	36.77% Salable
13.57% Unsalable	28.84% Unsalable
Check	Plain sulphur
24.42% Clean	39.93% Clean
36.10% Salable	39.77% Salable
39.48% Unsalable	23.26% Unsalable

In another sulphur test some potatoes were found to be injured by sulphur. This injury looks a little like scurf. (H. C. Odell, Weekly News Letter New York State Coll. Agr., July 31)

New Jersey: During the past several years tests have been conducted to determine the influence of various sources of nitrogen on the amount of scab. The results of 2 of these tests follow.

	Yield Bushels per A.	Clean Tubers %	Salable Tubers %	Unsalable Tubers %
Check	102.3	24.6	54.4	20.9
Nitrate of soda	123.2	20.0	62.9	17.1
Sulfate of Ammonia	122.5	42.0	50.2	7.8
1/3 Nitrate - 2/3 Sulfate	125.4	46.8	48.4	4.8
2/3 Nitrate - 1/3 Sulfate	136.6	31.4	58.1	10.5
- - - - - - - - - - - - -				
Check	140.8	15.2	40.8	43.9
All Nitrate of Soda	299.7	4.6	33.4	62.0
All Sulfate of Ammonia	308.6	42.6	36.4	20.9
1/2 Nitrate - 1/2 Sulfate	340.5	39.4	33.4	27.2
1/3 Nitrate - 2/3 Sulfate	371.9	29.6	45.8	24.5

New Jersey: Results from the use of sulphur very encouraging. In a number of cases an application of 500 lbs. of sulphur on fields which grew very scabby potatoes in 1921 resulted in a clean crop this year. In fertilizer tests where a comparison was made of nitrate of soda and sulphate of ammonia as a source of nitrogen the potatoes on the former plots were scabbed more severely than on the latter. (W. H. Martin, Oct. 28)

Virginia: We made a few preliminary tests of the inoculated sulphur supplied by the Gulf Sulphur Company. In some of our early work there was evidence of partial control of scab but where the sulphur was used heavy there was also evidence of sulphur injury. (T. C. Johnson, July 24)

Kentucky: One grower reports that ten years ago he could not grow a clean crop of potatoes. Formaldehyde soak for 8 years and corrosive sublimate last two years have given practically complete control. (Valleau & Gardner)

Treatment with inoculated sulfur: Through Mr. J. S. Gardner 2100 lbs. of inoculated sulfur was used on second crop potatoes on 17 1/2-acre plots using 150 lbs. and 300 lbs. per acre and a few 1/50 acre plots on which 600 lbs. were used. In no case was there any noticeable difference in the amount of scab in plots treated with 150 and 300 lbs. and the checks. Where 600 lbs. were used there was good control but a reduction of about 20% in yield. One trial of 600 lbs. was on a farm which was a cavalry barracks during the war. Quick lime was added in large amounts to the manure and as consequence potatoes were too scabby to dig. Six hundred pounds per acre increased the percent of marketable tubers by about ten times with a yield reduction of about 20%. It was very noticeable that in parts of a hill where sulfur could not be seen at digging time no control was obtained, while wherever sulfur was evident good control resulted.

Another trial of 400 lbs. gave no control, while 600 lbs. gave control but appreciably reduced the yield.

In another case 300 lbs. of uninoculated sulfur put on first crop gave no control in either the first or second crop.

In all cases sulfur was put on with a grain drill about two weeks before planting.

300 lbs. of uninoculated superfine sulfur was tried in two cases. It gave no different results from inoculated sulfur.

In one case where 150 lbs. and 300 lbs. per acre inoculated sulfur was put on two weeks before fall crop was planted the potatoes were so scabby that none were dug. (Gardner)

Treating seed potatoes at digging time: Because of the difficulty of drying treated seed potatoes at cutting time in the winter tests were carried on to determine the possibility of treating at digging time and drying and then keeping in the usual manner. Last year three men treated their seed in the fall before storing and this year ten men in Jefferson County have tried it. So far no injury has resulted to the tubers so treated. There is some evidence that this method of treatment will stop Fusarium dry rot which has already become well established on the surface layer of the potatoes. At present the rotted areas may be lifted out with the point of a knife and the tissue immediately below seems healthy. If this is the case it may be a factor in reducing soil infection as this disease appears more troublesome this year where the same disease appeared last year. (Valleau & Gardner)

Treating stored cut seed in the summer: One grower has practiced treating cut seed in the summer before planting. If the seed has been cut sufficiently long before treating so that callous has formed, no injury results. (Gardner)

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Scabby seed treated with bichloride or formaldehyde gave better stand and yield than untreated scabby seed. Dipping for 15 minutes in bichloride, or 30 minutes with formaldehyde gave the greatest yield of salable tubers, but longer treatments gave better control of scab. (Abst. Rept. Res. Comm. Potato Assoc. Amer. Boston meeting 1922)

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Jones, L. R., H. H. McKinney, and H. Fellows. The influence of soil temperature on potato scab. Wisconsin Agr. Exp. Sta. Res. Bul. 53: 1-35. 5 pl. 1922.

Development of potato scab is influenced by several environmental factors, temperature of the soil, among others. Potatoes grown in Wisconsin soil temperature tanks developed scab at all temperatures from 11 to 30°. As measured by number of scabby tubers, 23° seemed to be the optimum for scab development, or about 20° if proportion of tuber surface scabbed be made the criterion. Observations in the field show that scab is more prevalent in regions having high growing season temperatures, and is greater in hot than in cool summers. The mean soil temperature for July and August in the leading Wisconsin

potato districts approximate the optimum for scab development found in the controlled soil temperature experiments. The influence of soil temperature upon scab development seems to be exerted through the effect on tuber development. (Abst. Rept. Res. Comm. Potato Assoc. Amer. Boston meeting. 1922)

Olsen, G. A. Agricultural gypsum as a preventive of potato scab. Potato Mag. 47: 5-6. Feb. 1922. Also 53: 7, 23. 1922.

Four years of study at the Rhode Island Experiment Station show clearly that agricultural gypsum is effective in preventing the development of scab; it has also been found satisfactory at the Connecticut Station on heavy types of soil.

Waksman, Selman. The influence of soil reaction upon the growth of actinomycetes causing potato scab. Soil Sci. 14: 61-79. July 1922.

Blackleg caused by Bacillus phytophthorus Appel

The season of 1922 must have been exceptionally favorable for blackleg of potatoes, for collaborators in many states report the disease as more prevalent than usual.

Table 15. Estimated percentage loss due to blackleg in 1922. (Collaborators' estimates)

State	% loss	State	% loss	State	% loss
Vermont	1-	Virginia	2	South Dakota	Trace
Connecticut	.5	Tennessee	1	Kansas	3
New York	Trace	Indiana	Trace	Utah	2.5
Pennsylvania	2	Wisconsin	"	Idaho	.5
Maryland	1	Minnesota	2	Washington	Trace
West Virginia	Trace	North Dak.	3		

Apparently the low temperature in July coupled with the heavy precipitation of either June or July was responsible for the increase. In Oregon, where the damage was said to be much less than usual in 1922, there was hardly any rain for two months after planting time. The high temperature and slight precipitation of July in 1921 may in like manner have reduced the severity of the disease in that year. Figures taken from the U. S. Department of Agriculture Monthly Weather Review 49: 1921 and 50: 1922 are interesting to study in connection with this possibility.

Table 16. Departure from normal temperatures and precipitations in 1921 and 1922.

States where 1% or more of blackleg was reported in 1922	Departure from the normal temperature (F)				Departure from the normal precipitation			
	1922		1921		1922		1921	
	June	July	June	July	June	July	June	July
Vermont	+2.5	-0.7	-	-	+4.95	-0.29	-	-
Pennsylvania	+1.9	-0.2	+2.7	+3.9	+0.91	-0.53	-1.18	-0.03

States where 1% or more of blackleg was reported in 1922	Departure from the normal temperature (F)				Departure from the normal precipitation			
	1922		1921		1922		1921	
	June	July	June	July	June	July	June	July
Maryland	+2.7	-0.4	+2.2	+2.6	+1.10	+1.37	-1.54	-0.23
Minnesota	+2.6	-1.7	+6.2	+5.1	-1.00	-1.40	-1.27	0.00
North Dakota	+0.7	-1.9	+5.5	+3.9	+0.26	-0.21	+0.55	+0.43
Kansas	+2.3	-1.1	+1.6	+1.1	-1.87	+1.49	+0.81	-0.37
States where less blackleg than usual was present in 1922								
Ohio	+1.5	-0.9	+4.2	+4.2	+0.26	-0.21	-0.93	-1.03
Indiana	+1.4	-1.1	+4.7	+5.1	-1.91	+0.04	-0.33	-1.27
Idaho	+4.0	+1.1	+2.3	-0.6	-0.34	-0.26	-0.40	-0.43

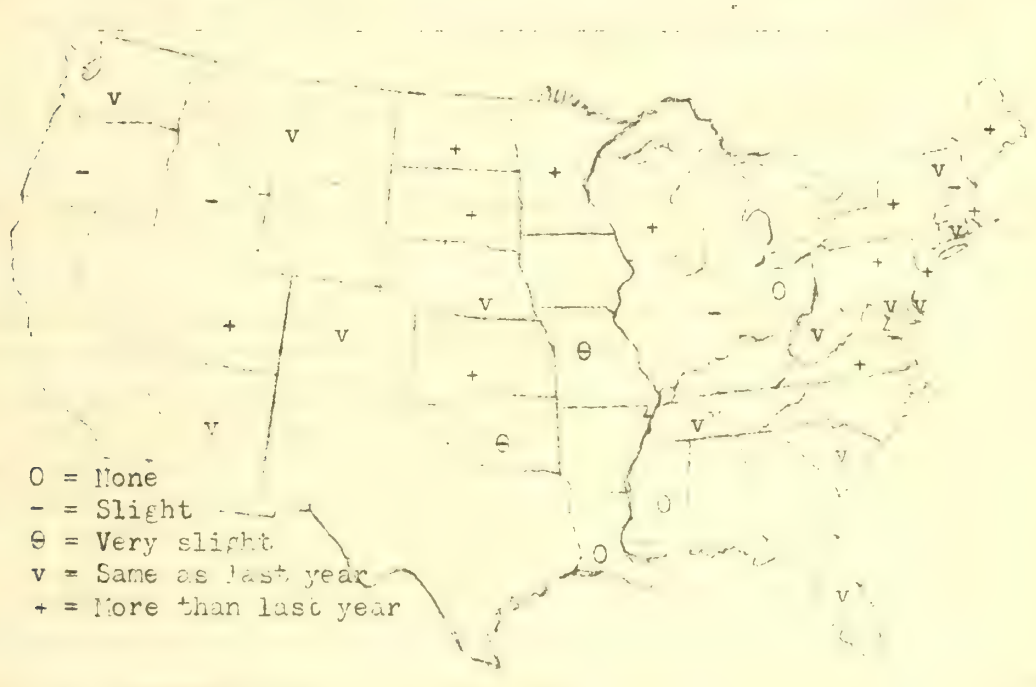

Fig. 3. Distribution of black leg in 1922, according to collaborators.

The introduction of infected seed tubers was the cause of much of the loss. This point was mentioned in many of the reports. In addition to the quotations given below the reader is referred to Plant Disease Bulletin 6: 19, 57, 80, 89, 90, and 111. 1922:

Connecticut: Not usually serious. A plant here and there in the field killed. (Clinton)

New York: Observed in ten counties this year. Where seed treatment is practiced there is never any trouble with this disease. (Chupp)

New Jersey: Present in some sections of the state. In one field in Monmouth County 5% of the plants infected. On the late crop in South Jersey blackleg was observed for the first time. (W. H. Martin, Oct. 28)

Virginia: Blackleg was more prevalent than it has been for a number of years. In some fields the loss from this source alone was fully 10% while in other fields it was not over .5%. (T. C. Johnson, July 24)

Wisconsin: In Early Ohio variety. Seed selection and treatment reducing amount. (Vaughan)

Minnesota: (Northwestern part) Very abundant, especially in Clay County. Many fields with as high as 50% of the plants infected observed in Clay County. Less prevalent further north and east. Numerous contrasts between treated and untreated fields. In general blackleg was more prevalent in the Red River Valley than elsewhere and in general more prevalent this year than last. (J. G. Leach, Aug. 3-5)

North Dakota: Last year the disease was fairly severe, present in scattered localities. Through movement of seed tubers, the disease has spread until this year it is serious. (Weniger)

Kansas: Traced to various lots of seed. Seed treatment reduced it materially. (Stokdyk)

Table 17. Dates of earliest appearance of blackleg in the United States in 1922, according to collaborators.

Date	Place	Date	Place
February 22	Federal Point, Florida	June 30	Farmington, Connecticut
May 24	Indianapolis, Indiana	June	Bridgeville, Delaware
May 24	Springfield, Missouri	June	Nassau County, New York
May	Oklahoma	July 7	East Kingston, New Hampshire
June 3	Fishery, Tennessee	July 11	Racine, Wisconsin
June 27	Allentown, New Jersey	July 20	Vermont
June 29	Dakota County, Minnesota	July	Sherman, South Dakota

Control measures are not mentioned often by the collaborators. In Wisconsin and New York where corrosive sublimate was used, as for Rhizoctonia, the injury from blackleg was reduced

Recent literature

Jennison, H. M. Potato blackleg with special reference to the etiological agent. (Abstract). Phytopath. 12: 444. Sept. 1922.

Concludes that the organism should be referred to Bacillus atrosepticus van Hall, and that the names B. phytophthorus Appel, B. solanisaprus Harrison, and B. melanogenes Pethybridge and Murphy should be considered as synonyms.

Mosaic

Mosaic is the most dreaded of all the diseases of potatoes. It is present in nearly every potato growing section, South Dakota being the only state from which reports were received that did not mention this disease. Comments on the severity of mosaic in the various states may be found in the Plant Disease Bulletin 6: 80, 81, 90, 91, 111, 150, 1922. According to the percentages submitted no disease causes such severe losses as does mosaic. Collaborators report the following percentages for their respective states: Maine (high percentage), New Hampshire 5%, Vermont 10%, Massachusetts 10%, Connecticut .5%, Pennsylvania 3.5%, New Jersey .5%, Maryland 2%, Virginia 1%, Kentucky 4% spring crop - 15% fall crop, Tennessee 3%, South Carolina trace, Mississippi 10%, Louisiana 25%, Texas trace, Arkansas 10%, Ohio, Indiana .5%, Illinois trace, Wisconsin trace, Minnesota 1%, Missouri 5%, North Dakota trace, Kansas .5%, Utah 7%, Arizona trace, and Idaho 10%.

The following states reported more than last year: New Hampshire, Vermont, New York, Wisconsin, North Dakota, South Dakota, Kansas, Utah, Idaho, and Washington. In reality there may not have been a larger percentage of disease present, but the season was such that the symptoms were not masked. This, at least, holds true for New York State, and is in agreement with the findings of the following investigators:

> Symptoms in potatoes appeared at the lowest temperature tested, 6° C., were best between 14° and 18° C., and disappeared above 20° C. Ten days at 36° C. did not kill the virus. (James Johnson (1)) (Abst. from Rept. Res. Comm. Potato Assoc. Amer. Boston meeting 1922.
>
> "..... Observations (1919-1922) indicate that low humidities, high temperatures, and intense sunlight which characterize the growing seasons of the semi-arid and arid west cause not only such pronounced masking of mosaic and other virus disease symptoms, but also such marked changes in healthy plants that the symptomatology determined in the humid sections and the methods of field inspection used there are inadequate in the west. This is especially true under dry-land conditions." (Geo. K. K. Link (2))
>
> "In the Rocky Mountain and other western potato growing sections the mosaic disease of potatoes has seldom appeared conspicuously in the generally characterized form. Some factor or set of factors masks the symptom of mottling..... It is believed that the large amount of short wave-length light in the sunlight at high altitudes stimulates chlorophyll production in mosaic diseased cells, the effect being to mask the common symptoms. Some antiseptic action is possible. The life of the mosaic plants is longer under these circumstances. Non-mottled mosaic plants transferred from high to low altitudes readily develop mottling." (H. G. MacMillan (3))

A tremendous amount of work has been done on mosaic diseases in general, and particularly on potato mosaic. Not the least interesting is that which deals with transmission of the disease to various hosts. (See "References" of Melhus (10), Elmer (6), Fernow (7), and Doolittle and Walker (5). A new field has been opened in the investigations on the cause of mosaic diseases. Space is not permitted here to discuss this interesting topic, but the articles by Smith (13), Kunkel (8), Nelson (11), McKinney (9), and Palm (14) (See "References") are sure to bring forth much worth while discussion and research.

It has been proved repeatedly that aphids transmit the infective principle from diseased to healthy plants. The question is raised by Miss Patch (2) whether among the twenty-one other species of sucking insects parasitic on potatoes, one or more may not function in a similar manner. Mosaic, according to observation in New York, spreads when no aphids can be found. (Mosaic was disseminated rapidly in the fields, even though no aphids could be found in many places - Chupp) Another important phase is the possible overwintering of the causal factor in perennial plants. This has been proved for tomato mosaic, and now Melhus (16) shows that Physalis longifolia carries a mosaic which is transmissible to potato.

Table 18. Dates of earliest appearance of mosaic in 1922.

Date	Place	Date	Place
March	Baton Rouge, Louisiana	June 17	Shawnee, Kansas
May 17	Indiana	June 25	Vermont
May 30	New Brunswick, New Jersey	June 30	Farmington, Connecticut
May	Hattiesburg, Mississippi	June	Nassau County, New York
June 3	Ramsey County, Iowa	June	Fayetteville, Arkansas
June 12	New Castle County, Delaware	July 1	Kingston, New Hampshire
June 15	Sturgeon Bay, Wisconsin		

Unlike many of the common potato diseases, mosaic attacks certain varieties severely and others only slightly. The degree of susceptibility or resistance of any one variety seems to be uniform throughout the country, as is shown by the following reports:

New York: More common on Green Mountain type than on smooth or russet rurals. (Chupp)

New Jersey: More abundant on Green Mountains and American Giant varieties than on the Irish Cobbler. (W. H. Martin)

Maryland: McCormick very susceptible. (Temple & Jehle)

Mississippi: Bliss Triumph continues to be very susceptible. We are urging our growers to try certified northern grown stock, especially the Wisconsin "Smith" strain and some Nebraskan strains. (D. C. Neal)

Indiana: Not prevalent in late Rurals. (Gardner)

Wisconsin: Major on Triumph; considerable on Green Mountain. (Vaughan)

Missouri: Noted on Early Ohio, Cobbler slightly. Most severe on Triumph. (W. E. Maneval)

Idaho: Evidently different types of mosaic. Idaho Rural more susceptible than Netted Gem. (Hungerford)

Wisconsin: Most ever seen. Some plantings of unselected Triumph stock show 100% infected plants. Even the Smith strain shows 2% on the Spooner Branch Station. (Vaughan)

Control Measures

In the states where potato seed growing is not possible the growers are quite generally beginning to use northern certified seed, and evidently with gratifying success, according to the following reports from collaborators.

New York: (Nassau County) Mosaic in certified seed test plots averaged about 1%, while in common seed the average was about 14%. The ordinary common seed showed much more mosaic than here mentioned. Many fields run nearly 50%. (H. C. Odell, Weekly News Letter, July 10)

Arkansas: Best results are from locally selected mosaic-free plants. (Elliott)

Louisiana: Had excellent success with certified seed this season. (Edgerton)

Northern growers are planting the best seed obtainable and attempting to keep down the percentage of loss by roguing the diseased hills. It is not always possible to obtain seed tubers sufficiently free from mosaic to justify roguing. The source of clean Green Mountain seed is limited, thus making it necessary to scout for isolated disease-free seed, or in some way grow healthy stock from that which has been diseased. The latter alternative has been made possible by the work which Blodgett, Fernow and Perry (4) have done on tuber indexing. It has been demonstrated that large enough quantities of seed tubers can be indexed to plant an isolated seed plot, and a number of clean strains have already been started by this method in New York.

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English summary (The mosaic disease of the Solanaceae, its relation to phloem-necrosis and its effect on potato culture): p. 71-74.

Leafroll

Leafroll is evidently not so general in its distribution as is mosaic. This may be the result of soil and climate, either repressing the disease or masking the symptoms, or it may be due to resistant varieties grown in a given locality. For instance, in South Carolina and Mississippi the disease is unimportant or absent. The same holds true for Wisconsin, Minnesota, South Dakota, Kansas and Washington. On the other hand, the trouble is very pronounced in New England, New York, Pennsylvania, New Jersey, Delaware, Kentucky, Ohio, Michigan and Indiana. Idaho includes another area where the disease is doing much damage. Following are the recorded percentages:

30	- Kentucky	3	- Idaho
15	- Pennsylvania	2.5	- Vermont
7	- Ohio	2	- Maryland, Virginia
5	- New Hampshire, Massachusetts, New York, Indiana	1.5	- New Jersey
		1	- Delaware

The above percentages with a few additional notes by collaborators will give an idea of the great losses incurred through leafroll.

New York: (Onondaga County) Further examination of potato fields justifies the earlier indication that such diseases as leafroll will be much more in evidence than last year. Leafroll in potato fields which were practically free last year is showing from 10% to 20%. (D. D. Ward, July 17)

(Monroe County) Leafroll is serious in many fields going as high as 50% in some. (A. L. Pierstorff, July 24)

New Jersey: Very prevalent throughout the state. Some fields observed showing as much as 85%. Especially severe in the Irish Cobbler variety. On late crop grown for seed, leafroll principal cause for disqualification of seed entered for certification. The last week of September a rolling of the top leaves of Irish Cobblers became common, probably the result of a late infection by leafroll. (W. H. Martin)

Kentucky: Seems to spread much more rapidly than mosaic. Stock practically free in 1921 show 95% infection in fall of 1922 when planted. Spindle sprout tubers selected last winter were without any net necrosis in spring but produced leafroll plants. Tubers from them small but do not show net necrosis. Some other tubers in same lot last winter had spindle sprout and net necrosis.

Spindle sprout is very common in leafroll stock in Kentucky. Spindle sprout tubers usually send up one weak stalk which branches only slightly. If branches are developed they are usually much longer than the central stalk. (Valleau)

New Jersey: Tests conducted with leafroll and healthy plants over a period of two years show a reduction of 95.3 bushels in yield as the result of the presence of the disease. Especially severe on Irish Cobblers.

Effect of leafroll on yield

Condition of plants	Height of vine cm.	Yield per acre,-bu.
Lower leaves pronounced roll - Fall 1921	36	146

		Height of vine cm.	Yield per acre Bu.
Medium leaves considerable roll, Spring1922		47	138
Top leaves small, Fall 1922		-	126
Lower leaves normal	Fall 1921	50	201
Medium leaves normal	Spring 1922	59	191
Top leaves normal	Fall 1922	-	221

(W. H. Martin)

Manitoba, Canada: Rather serious. The use of certified seed is relieving the situation somewhat. (G. R. Bisby)

As in the case of mosaic, there now have been reported three types of leafroll, the common leafroll, giant hills and spindling tubers or marginal leafroll. According to Quanjer (2) marginal leafroll, which involves only the borders, is not so common as the true leafroll; there is no phloem necrosis and starch transport is very little disturbed, and it has not been determined whether it is infectious

Fernow (1) and Schultz and Folsom (3) give descriptions of spindling tuber, which are quoted below. (See under other degeneration diseases.)

The statements made about etiology, dissemination and control of mosaic apply equally well to leafroll. In the matter of varietal susceptibility, however, the conditions are reversed. Those varieties which are most susceptible to mosaic are usually more resistant to leafroll, although there is probably no variety which is immune.

Massachusetts: Most often recognized on Irish Cobbler. (Osmun)

New York: More common on the smooth and Russet Rurals. (Chupp)

New Jersey: Especially severe on Irish Cobblers. (W. H. Martin)

Idaho: More in northern Idaho in non-irrigated section. Netted Gem potatoes evidently more susceptible than Idaho. Rurals. (Hungerford)

The control measures are the same as those for mosaic. Indexing and roguing are both practiced. According to Chupp, in New York, careful roguing and isolated seed plots will almost entirely eliminate leafroll. He says it is easier to cope with this disease than with mosaic. Gardner in Indiana says:

> "Field tests with tubers indexed by greenhouse tests showed marked reduction in yield due to leafroll."

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Martin, W. H. "Spindle tuber," a new potato trouble. Hints to potato growers. New Jersey State Potato Assoc. 3: 1-4. 1922. (Symptoms are described in detail, the disease is discussed, and reduction in yields given.)

Tipburn (non-parasitic) and hopperburn induced by leaf hoppers (Empoasca mali)

> "There appear to be at least two types of tipburn; one is specific and may be produced artificially by allowing potato leaf hoppers to feed on the plants, or by injecting extracts of nymphs or adults of this species. Juice from such plants may be used to infect other plants. Sunlight is not a factor in the development of this tipburn.
>
> "Another type of tipburn occurs in the field in the absence of leaf hoppers and may be produced experimentally by subjecting the plants to intense illumination under dry conditions. This is believed by Lutman to result from excessive water loss from the leaves principally through the water pores at the leaf margin and apex. Direct destruction of chlorophyll and plasmolysis of the mesophyll cells are accessory effects." (Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston meeting. 1922)

Some of the collaborators in their reports differentiated between tipburn and hopperburn, while others did not. It seems advisable therefore to treat them under the same heading.

POTATO - Tipburn

The amount of tipburn and hopperburn prevalent was comparable with last year and the average year. In some states it was much more severe, while in others it was less.

Table 19. Prevalence and importance of tipburn and hopperburn in the United States in 1922, according to collaborators.

State	% loss	State	% loss	State	% loss
Vermont	1-3	West Virginia	20	Indiana	5
Massachusetts	Trace	Kentucky (spring crop)	4	Illinois	3
Connecticut	10	South Carolina	1	Michigan	Destructive
New York	5	Louisiana	2	Wisconsin	5
Pennsylvania	4	Mississippi	1	Minnesota	6
New Jersey	1	Texas	Present	Iowa	15
Delaware	4.5	Arkansas	3	Missouri	10
Maryland	1	Oklahoma	Considerable	South Dakota	10
Virginia	1	Ohio	12	Kansas	Considerable
				Idaho	Unimportant

The three following reports are given by collaborators:

Connecticut: After field died, hard to tell from the late blight without microscopic examination. (Clinton)

New York: Less common in St. Lawrence Valley, and on high altitudes in other parts of the state. Although rainfall was plentiful, tipburn and hopperburn were plentiful. Careful spraying reduces the loss. (Chupp)

New Jersey: Most of the tipburn observed on both the early and late crop is believed to be due to leaf hoppers. In South Jersey the Irish Cobbler vines were found to be covered with leaf hoppers. The injury was first observed July 1st. Leaf hoppers were found as late as October 10 on the late crop and were responsible for the early dying of unsprayed fields. (W. H. Martin, Oct. 28)

Table 20. Dates of earliest appearance of tipburn in the United States in 1922, according to collaborators.

Date	Place	Date	Place
April	Louisiana	June	Hayti, South Dakota
May 16	Agricultural College, Mississippi	July 1	Salem County, New Jersey
May	Oklahoma	July 10	Vermont
June 3	Hennepin County, Minnesota	July 29	Canaan, Connecticut
June 16	New Castle, Delaware	Aug. 2	Columbiana, Ohio
June 28	Rhinelander, Wisconsin		

Weather conditions were an all-important factor in the production of tipburn, but did not influence the damage done by leaf hoppers.

New York: In spite of one of the coolest, wettest seasons experienced in years, this section is experiencing almost a scourge of leaf hoppers. Early and medium early planted potatoes are severely affected. (C. R. Stevenson, August 28)

Wisconsin: Correlated with dry weather. Very little damage where there was plenty of rain. (Vaughan)

Minnesota: During hot period, June 1-3, tipburn abundant, leaf hoppers absent, checked by rain; later cases confused with hopperburn. (Section of Plant Pathology)

Missouri: Very hot, dry June seemed to make conditions more favorable for trouble. Late crop also affected with hoppers abundant. Data by E. M. Page. (W. E. Maneval)

Very few comments have been received regarding varietal susceptibility. From all indications the most resistant varieties are susceptible enough to suffer great injury in areas where the weather is hot enough to produce tipburn, or the leaf hoppers are plentiful enough to cause damage.

New York: In most sections the Rural Russet potato is least affected. (Chupp)

Minnesota: Triumph and Early Ohio are very susceptible. (Section of Plant Pathology)

Control measures:

Spraying as a control measure was uniformly successful, as will be seen by the following reports:

New Jersey: A spraying experiment conducted in South Jersey gave good control of hopperburn. On July 14, plots sprayed three times with Bordeaux mixture showed 2.5% of the leaves dead as compared with 50.3% on the unsprayed checks. (Martin)

In a spraying test at Elmer on first crop Irish Cobblers there was only a trace of early blight but leaf hoppers were present in great numbers. The various plots received four applications of home made Bordeaux mixture (5-5-50). A count of dead leaves on July 14 gave the following results: Check 50%, Sprayed 5.4%. Most of the injury was apparently that caused by the activities of the leaf hoppers. The average yield of the various plots was, Check 162.6 bu. Spray 201.7. (Martin)

Five applications of Bordeaux mixture gave increase of 32.3 bushels, largely due to hopperburn control. (Martin)

West Virginia: Vines killed prematurely. General, but eastern and western sections suffered most severely. 5-5-50 Bordeaux increased yield of marketable potatoes from 50 to 75 per cent. (Giddings)

Ohio: Very prevalent in unsprayed fields, can be controlled with Bordeaux. (Freda Detmers)

Wisconsin: Very well held in check by applications of Bordeaux. (Vaughan)

South Dakota: Very severe this year. Hoppers in great numbers of unsprayed fields. Fields sprayed with Bordeaux remarkably free. (Evans)

".....Spraying may result in greatly increased yields where only tipburn and early blight are factors....." (Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston meeting. 1922)

References:

Ball, E. D. Insects as disseminators of plant diseases, II. Systematic relations of carriers. Phytopath. 12: 229-231. 1922.

Eyer, John R. Preliminary note on the etiology of potato tipburn. Science n.s. 55: 180-181. Feb. 17, 1922.
"Tipburn of the potato plant may be produced by the extract made from macerated nymph or adult, Empoasca mali Le B., and is transmissible by direct inoculation. This points to the existence of a 'specific', either normal or extraneous, transmitted by the leaf hopper as the cause of the disease."

_____ Notes on the etiology and specificity of the potato tipburn produced by Empoasca mali Le Baron. Phytopath. 12: 181-184. April 1922.

Fenton, F. A. and I. L. Ressler. Artificial production of tipburn. Science 55: 54. 1922. Jour. Econ. Ent. 15: 288-295. 1922.
"Injection of emulsions prepared from adult leaf hoppers (Empoasca mali) but not from nymphs produced symptoms of tipburn in potato plants." (Abst. from Rept. Res. Comm. Potato Assoc. Amer. Boston meeting, 1922)

Folsom, Donald and E. S. Schultz. Potato tipburn in northeastern Maine. (Abstract)Phytopath. 12: 36. Jan. 1922.
Leafhoppers were absent and true tipburn resulted from hot and dry weather conditions as well as certain degeneration diseases.

Leach, J. G. Leaf hopper injury of potatoes. (Abstract) Phytopath. 12: 37.Jan. 1922. (A leafrolling curl disease; not ordinary hopperburn)

Lutman, B. F. Relation of structure of potato leaves to tipburn. Potato Mag. 5[6]: 22-23. September 1922.

_____ The relation of water pores and stomata of the potato leaf to the early stages and advance of tipburn. Phytopath. 12: 305-333. 15 figs. 1922.

Other Degeneration Diseases

The nomenclature and rather incomplete descriptions of diseases which are either different phases of mosaic or leafroll, or closely related troubles, have become so numerous and so mixed that it is impossible to say which are distinct diseases, and which are merely phases of the same trouble. Following are some of the terms now being used: leaf-rolling mosaic, mosaic dwarf,

severe mosaic, mottled mosaic, corrugated mosaic, curly dwarf, mottled curly dwarf, calico, marginal leaf-roll, and spindling tuber, giant hills, crinkle, leaf drop, russet dwarf, streak, stipple-streak, spindle-sprout, and others.

Spindle-sprout, probably caused by poor storage of seed was reported by Clinton of Connecticut. In Idaho the spindle-sprout was usually connected with leafroll.

Spindle-tuber or long-tuber and marginal leafroll were present in Maine, New York, New Jersey and probably other states.

> "Transmission of spindling-tuber disease, commonly designated as 'running-long' or as a type of 'running out,' has been obtained with tuber grafts, vine grafts, leaf-mutilation inoculation, and aphids. Symptoms are erect and spindling stalks, smaller, more erect and somewhat darker green leaves than in healthy foliage, and spindling, spindle-shaped tubers (instead of flat, oblong tubers as in healthy Green Mountains) with more numerous and more conspicuous eyes and with a smoother skin and consistency less firm than in healthy tubers. Spindle-tuber is in the leading commercial varieties in all percentages of incidence; spreads about as readily as mosaic; infects hills in part, resulting in diseased and healthy progeny from the same hill or even from the same tuber, as in mosaic and leafroll; and reduces the yield considerably. In addition to carrying mild mosaic, leafroll, and spindling-tuber, aphids transmit leaf-rolling mosaic, severe mosaic, and unmottled curly-dwarf. Leaf-rolling mosaic forms a curly-dwarf when in combination with spindling-tuber. Severe mosaic is more injurious and infectious, and causes current-season symptoms oftener and sooner than mild mosaic or leafrolling mosaic. If isolated from other degeneration diseases, mild mosaic strains will not acquire different symptoms. Mosaic and leafroll, together, or other degeneration disease combinations, may reduce tuber production affecting self-elimination. Transmission to healthy plants decreases as the distance from diseased plants increases, and fluctuates seasonally and regionally with aphid infestation." (Schultz, E. S. and Donald Folsom. Spindling-tuber and other degeneration diseases of Irish potatoes. Phytopath. 13: 40. 1923)

> "The marginal leaf-roll disease of potatoes was recognized as a disease in 1921, when tuber units showing a large percentage of marginal leaf-roll were seen. The most striking characteristic of the disease is the elongation of the tubers which is often extreme. The vine shows an upright habit and is frequently dwarfed. The leaflets are slightly rolled at the margins, which are often crinkled, and are somewhat smaller than normal but do not show the extreme rolling which occurs in true leaf-roll. The stolons are not shortened as in true leaf-roll and there is no phloem necrosis. The examination for phloem necrosis were made by Dr. Artschwager. The yield is considerably reduced. That the disease is transmissible is shown by the fact that among tuber units having a common ancestry some had degenerated while others were normal. A healthy

plant on which a diseased scion was grafted produced a typically elongated tuber. The progeny has not been grown. The disease has been observed in Rurals, Green Mountains and Cobblers. The disease was previously mentioned by Quanjer. He noted the absence of phloem necrosis but not the elongation of the tubers." (Fernow, Karl H. Spindling tuber or marginal leaf-roll. Phytopath. 13: 40. 1923)

From observations the indications are that the disease is of a similar nature to mosaic or leafroll, according to Martin in New Jersey, who says:

"This trouble was first observed in South Jersey on the Irish Cobbler variety in the fall of 1921. The vines of affected plants grow upright, branch but little and are smaller than normal. The leaves are much more narrow and pointed than typical Cobbler leaves. In some cases the margins of the leaves roll in a manner suggesting leafroll. The tubers are long, narrow, smooth skinned, and show more eyes than the true Cobbler.

Table I

Type of seed	Length	Width	Ratio Length to width
Fall 1922:			
Affected Cobblers	7.35	5.20	1.41
Healthy "	6.73	6.19	1.08
Summer 1922:			
Affected "	5.76	4.10	1.40
Healthy "	5.69	5.07	1.10

"The condition of the vines of the various lots of seed is shown in Table II. (Observation July 17)

Table II

Type of seed	Height cm.	% dead leaves
Affected Cobblers	30.6	57.9
Healthy "	47.2	22.6

"The yield of the various plots is shown in Table III.

Table III

Type of seed	Primes Bu.	Sec. Bu.	Culls Bu.	Total Yield bu.
Affected Cobblers	10.4	32.0	23.2	65.6
Healthy "	89.6	20.4	10.8	120.8

Streak was present in many fields in New York State. It was more commonly found in fields planted with Maine seed. Russet-dwarf - Idaho - Idaho Rurals most susceptible. Disease similar to if not type of mosaic (Rutgerford)
Calico - relatively unimportant in Idaho.

Recent literature on degeneration diseases (see also mosaic, leafroll, and tipburn).

Atanasoff, Dimitar. Stipple-streak disease of potato. Meded. Landbouwhoogesch. Wageningen 24: 1-32. 1922.

_____ A study into the literature on stipple-streak and related diseases of potato. Meded. Landbouwhoogesch. Wageningen 26: 1-52. 1922.

Schultz, E. S. and D. Folsom. A "spindling-tuber disease" of Irish potatoes. Science 57: 149. 1923.

_____ Transmission of potato streak. (Abstract) Phytopath. 12: 41. Jan. 1922.

Yellow dwarf (causal organism not yet determined)

Yellow dwarf is probably the most menacing of all the newly discovered potato diseases. This season it was found in Vermont, New Jersey, and Pennsylvania, in addition to New York. Disseminated by means of the seed, it has reached every potato county of the last named state. As yet it has caused only minor losses, but there are now enough badly infested fields to show that when the inoculum once gets into the soil, it continues to increase until the field becomes unprofitable for potatoes. Not only is the inoculum carried with the seed and in the soil, but the disease spreads from one plant to another. It was thought at first that the diseased tubers were so evident that naturally they would be discarded at planting time. This idea has proved fallacious, for the seed pieces which produce affected hills, are generally from large, healthy-appearing tubers. These evidently come from plants infected late in the season. No variety has been found which is immune.

New York: Will live in the soil indefinitely. No treatment known. Found in 121 of 373 fields inspected. No great loss yet, but the disease is menacing seed production. (Chupp)
Onondaga County - Considerable yellow dwarf is being found in blue sprout fields, running as high as 10% in some cases. Some yellow dwarf is found on the Green Mountains. (D. D. Ward. N. Y. State Col. Dept. Pl. Path. & Ent. Weekly News Letter, July 24, 1922)
Ulster County - One potato field was found containing yellow dwarf disease. (E. V. Shear. N. Y. State Col. Agr. Dept. Pl. Path. & Ent. Weekly News Letter, July 17, 1922)
Suffolk County - More found this year than last. Vogel.

New Jersey: Yellow dwarf described by Barrus and Chupp found in isolated cases in Monmouth, Mercer and Middlesex Counties. Seed from New York State. (Martin)

Pennsylvania: The only place where we have seen undoubted specimens of yellow dwarf is in Luzerne County. No doubt the disease has occurred elsewhere. (C. R. Orton)

Vermont: Never noted in Vermont before. Observed in several sections including Ira.

References

Barrus, M. F. and Charles Chupp. Yellow dwarf of potatoes. (Abstract) Phytopath. 12: 39. Jan. 1922. Abstract of reference below.

Barrus, M. F. and Charles Chupp. Yellow dwarf of potatoes. Phytopath. 12: 123-132. March 1922. (This disease is described, being prevalent in a number of varieties in New York State. It apparently is seed-perpetuated.)

Fig. 4. Known distribution of yellow-dwarf in 1922. Soil infestation seems most abundant in the Mohawk and Champlain Valleys of New York, although there is a rather general infestation in the area represented by the shaded portion.

Poor stands, and decaying seed pieces

In New York 1800 acres of potatoes were inspected in 24 counties and the average number of missing hills was 7.97%. There were many causes for these missing hills, such as planter skips, rhizoctonia, drowning, poor seed etc. Regarding poor stands, T. C. Johnson writes from Virginia:

> "In a general way the Irish potato crop in Eastern Virginia has been somewhat unsatisfactory this year. In the first place, the seed potatoes received from the North were in rather poor condition. Some of them were badly overgrown while others were markedly infected with Rhizoctonia, and some evidences of late blight were also present. These conditions, together with local conditions at the time of planting, caused a very poor germination. However, on the whole I think the germination was better than it was in 1921. The extreme wet weather experienced during the months of January, February, and early part of March necessitated the planting of potatoes when the ground was really too wet. This, together with the disease conditions mentioned, was undoubtedly an important factor in causing poor germination.
>
> "There were very few potatoes treated with formaldehyde before planting. We treated ours at the Norfolk Station and also at the Eastern Shore Station with cold formaldehyde, using 1 pint to 30 gallons of water. This seems to have given us the customary good results. The germination at our Eastern Shore Station in Accomac County was fully up to the average. In some of our fields we had from 95 to 98 per cent of a stand, while in others the stand was from 85 to 95 per cent."

The use of sulphur on cut seed

Valleau and Gardner give the following information regarding the use of flowers of sulfur as a dust on cut seed in Kentucky:

> "It is common practice in the potato growing sections of Kentucky to select seed potatoes in the fall, put them in the cellar until work slackens up in the winter ard then cut them and put them in cold storage, for the fall crop. There has been a general impression that northen grown seed stock can not be handled this way. Northern grown potatoes cut in winter rolled in flowers of sulfur and put in cold storage, then shipped half way across the state the next summer, gave 100 per cent stand. The Kentucky stock has been found to come through the summer with much less shrinkage and if dusted with sulfur no growth of the cut surfaces with fungi as is common with undusted pieces. After a few demonstrations the growers in Jefferson County last year bought six tons of sulfur at cutting time. They were so well pleased with the condition of the seed at planting time that the practice will undoubtedly be more widespread this winter. As to field control of diseases, there is some question, but one grower commenced this practice 12 years ago and has used it each year since. At the time his land produced very scabby potatoes. During the last five years

he has had practically no scabby potatoes. In spite of the fact that scab was very prevalent this year, his crop was clean. He believes it is the result of this cumulative effect of the sulfur in gradually reducing the scab present in the soil. This practice seems well worth trying on a large scale where scab is a factor. It will never introduce enough sulfur into the land to cause damage, as only 10 ounces are used to the bushel. This man has raised very little else on his farm during the past 12 years, than potatoes. In one case, unrotted seed picked out of bags in which three fourths of the potatoes had a slimy soft rot, were rolled in sulfur and planted. They gave as good a stand as other potatoes taken from clean stock.

"In boy club work, in two cases boys cut and dusted seed with sulfur in tuber unit tests, conducted in rows adjacent to those of their fathers, who cut and dropped the freshly cut seed. In both cases the dusted seed gave a stand of about 92% and the undusted was reduced to about 30%.

"Another grower reports that he has always been troubled with scab. Began dusting seed pieces with sulfur 6 years ago. This year treated with $HgCl_2$ and dusted with sulfur, cleanest crop he ever raised in spite of bad scab year."

Miscellaneous parasitic diseases

Cercospora concors (Casp.) Sacc. - Found in Schuyler and one other county, New York; on upper leaves. Seemed to have followed injury to leaves due to low temperature at night. (Chupp)

Anthracnose caused by Colletotrichum atramentarium (Berk. & Br.) Taub. was observed in Stark County, Ohio.

Bacterial wilt caused by Bacterium solanacearum EFS. was collected in Maryland, South Carolina and Florida. A. C. Foster writes from Sanford, Florida, giving the following information:

"Specimens of the wilt were collected and laboratory studies made. The wilt organism was easily identified after isolation from both tuber and stem pieces. The characteristic appearing colonies of Bacterium solanacearum made their appearance on all attempts at isolation."

Ludwig of South Carolina feels that the greatest importance of the disease lies in the fact that it unfits soil for any solanaceous crop.

Southern blight caused by Sclerotium rolfsii Sacc. was "found in Spartanburg and Charleston Counties, South Carolina. In the latter county, it is reported by Tisdale as doing 5% damage in one field." (Ludwig) Edgerton reports that the fungus is causing about 2% loss in Louisiana. In different fields the percentage varies from 0 to 10. Reference: Edson, H. A. and M. Shapovalov. Parasitism of Sclerotium rolfsii on Irish Potatoes. Jour. Agr. Res. 23: 41-46. January 6, 1923.

Sclerotial disease caused by Sclerotinia libertiana Fckl. Lachaine, C. W. Sclerotial disease of the potato. Ann. Rep. Quebec Soc. Prot. Plants. 14: 105-109. 1922.

Black dot ("dartrose") caused by Vermicularia varians Duc. B. T. Dickson (1) gives the following concerning this disease:

"Ducomet in France in 1908 reported the occurrence for the first time of a disease which he called 'dartrose' caused by Vermicularia varians. McAlpine some two years later found it in Victoria, Australia, and Doidge more recently in South Africa. McAlpine named it 'black dot disease,' an excellent descriptive name.

"In the late summer and autumn of 1921 I discovered what appears to be the same disease at Macdonald College in Quebec. This is the first time its appearance is noted on this continent and a full description will be given later elsewhere.....

"Ducomet states that this organism is parasitic on tomato and Physalis peruviana. I have artificially infected tomato but have not yet tried Physalis sp.

"This disease is serious only in that it weakens plants and therefore reduces the crop. Exactly to what extent it is of economic importance it is as yet impossible to state.

"McAlpine advocates burning the haulms of diseased plants and selecting clean tubers for planting."

References on black dot:

(Cited)

1. Dickson, B. T. Diseases of the potato. Scient. Agr. 2: 325-327. June 1922.

(Not cited)

Crépin, C. Une maladie grave de la pomme de terre dans le nord de la Loire. Compt. Rend. Acad. Agr. France 8: 803-806. 1922.

Dickson, B. T. Plant diseases of 1921 in Quebec. Quebec Ann. Rept. 14: 52-58.1922.

Foëx, Etienne. La dartrose de la pomme de terre. Compt. Acad. Agr. France 8: 844-848. 1922.

Wilt caused by Verticillium alboatrum Reinke and Berth. was of minor importance in New York, Ohio and Wisconsin. In Oregon, on the other hand, the fungus caused considerable loss. Van Trump reports: "Severe in western Oregon. Clackamas County Agent Holt estimates 10-15% crop loss. Fruit inspector Walker estimates 40% loss in Multnomah County. Quite severe in Marion County in the red hill soil." Freeman Weiss of the Bureau of Plant Industry reports that in Maine he saw "several fields where there were from one to two plants in 200, usually in patches with greater density than this rate, infected with wilt," which was referred to by Schultz and Folsom, who had made cultures in previous years, as Verticillium wilt.

Wilt caused by Fusarium eumartii Carpenter was found killing plants in one field in Allegany County, New York. The infection started from one hill and spread in all directions until a space of several rods in diameter was invaded. The fungus was much more virulent than Fusarium oxysporum, causing an infection of the entire base of the stem, and passing down the stolons affected the stem end of the young growing tubers. The disease is not very prevalent in the state, but appears in a few fields each season. (Chupp)

Tuber rots caused by different species of Fusarium have been observed in a number of states: Ohio, Iowa (stem-end rot, 6% loss), Minnesota (.5% loss), South Dakota (trace), North Dakota (3% loss caused by Fusarium discolor sulphureum), Colorado (common on market potatoes), and Washington (dry rot causing considerable loss).

G. L. Prince reports a Fusarium from Monte Vista Section, Colorado:

> "Quite a bit of Fusarium is being found in the Valley this season, or at least it looks like Fusarium to me, but the local inspectors have been calling it sun-scald, and seem undecided as to just what the trouble is. Reports indicate that it is scattered over the entire district but is found less in the outlying district where potatoes are being planted for the first time, and in fields where proper crop rotations have been practiced." (U.S.Bu.Agr.Econ.Fruit & Veg.Div.Letter Oct. 12, 1922)

Reference:

Kock, Gustav. Einiges über Kartoffelkonservierungsmittel. Oesterreich. Zeitschr. Kartoffelbau. 1: 37-38. 1921. (Sulfur and a number of proprietary compounds, such as Megasan K, Beka-Erdapfelschutz and Uspulunbolus, have been shown to be ineffective in preventing the development of storage rots of potatoes due to late blight, Fusaria, etc.)

Jelly end rot caused by Fusarium radicicola Woll. was present in Ohio, Idaho and Washington. Only slight losses were reported.

Powdery dry rot caused by Fusarium trichothecioides Woll. was found in seed potatoes examined at Prescott, Arizona.

Leak or rot caused by Pythium debaryanum Hesse or Rhizopus nigricans Ehrenb. was reported from Connecticut (one report), Texas (1-40% loss at digging time), Ohio, Minnesota (15% of tubers ruined in one acre plot), and Idaho (important with mid-season potatoes which are not properly handled.

Slimy soft rot caused by bacteria was, as usual, one of the most important causes of losses in transit.

Silver scurf caused by Spondylocladium atrovirens Harz. was of minor importance in New York, West Virginia, Indiana, Idaho, and Washington. No doubt it is present in many other states.

Powdery scab caused by Spongospora subterranea (Wallr.) Johnson lightly infected 5% of the tubers in a one-acre field of Irish Cobblers in St. Louis County, Minnesota. Previously to 1922 it has been reported to the Survey definitely from Aroostook and Washington Counties, Maine; Franklin, Clinton and Hamilton Counties, New York; Luzerne County, Pennsylvania; Oconee County, South Carolina; St. Louis, Lake and Carlton Counties, Minnesota; Tillamook and Clatsop Counties, Oregon; and Snohomish, King, Pierce, and Clallam Counties, Washington. Reference: Shapovalov, Michael. Relation of potato skin spot to powdery scab. Jour. Agr. Research 23: 285-295. 1923.

Root rot caused by Armillaria mellea Vahl. was found at Hudson, Wisconsin. The crop was grown in a recently cleared field.

Root knot caused by Heterodera radicicola (Greef) Müll. was reported from Mississippi, Louisiana, Arkansas and Washington. In Arkansas where the injury was described as a dwarfing of the plants, pimpling of the tubers, and storage injury and the loss was estimated as 8%. Reference: Milbrath, D. G. The potato as one of the chief agents in the distribution of root-knot nematode (Heterodera radicicola). Month. Bul. Dept. Agr. Calif. 11: 268-371. Apr. 1922.

Curly dwarf (see mosaic)

Net necrosis (cause not mentioned) was much more prevalent in New Hampshire than usual. Complaints were received from all parts of the state. A trace was also observed in South Dakota and New York.

Miscellaneous non-parasitic diseases

Scald is a term used too liberally to describe certain conditions found in the southern or new potato crop, according to G. K. K. Link, who gives the following information (U. S. Bur. Agr. Econ. Food Products Inspection Service Memorandum):

> "Our own original conception of scald has been modified and we are inclined to think that there is much less scald than we once supposed. To be sure, there is a true scald. This is marked by blistering and a greenish purple discoloration of the skin and softening and a grayish to black color of the killed flesh. Scald is closely akin to black heart in symptoms and in cause. The dead areas, if superficial, usually are quite extensive. Generally scald involves a good bit of the affected tuber. The dead tissues may be soft with a turgid exterior or they may be dried into a starchy mass with a wrinkled exterior. Recently quite a bit of true scald has been found in No. 2 Florida stock which had all the earmarks of having been held a long time.
>
> "It must be remembered that several diseases caused by fungi may show symptoms very similar to those of scald. These are leak (now known to occur in southern stock), which resembles the blackheart type of scald and which shows no fungus; the wet type of Fusarium rot which resembles scald save that it is accompanied by a copious growth of mold; and Sclerotium rot, which also resembles scald somewhat and which is easily confused with it because there frequently is no fungus growth. Many leaky barrels show no fungus growth because the stock was handled so that all traces of fungus are obliterated.
>
> "Most of the confusion has come in classing a peculiar type of bruise as scald. The type of bruise is found in the early stock which is dug while it is very tender and full of water. It seems to be most prevalent in Florida Cobblers and Spaulding Rose. The spots usually are small and comparatively very deep. At times they occur in such abundance on a tuber that one is disinclined to believe that a tuber can be wounded in so many spots without being crushed. The bruises probably are due to slight pressure or jars during or immediately after digging. Usually the spots are less than half an inch in diameter, about one quarter inch being most common, and range from one-eighth to about three-eighths inch in depth.
>
> "The skin of such spots is not broken and has a bluish appearance. The spots are sharply sunken, that is, the edge of the depression is almost at right angles to the tuber's surface. The spots remind one very much of deep holes in a granite block pavement. The interior appearance of this spot varies with external conditions. If these are dry there usually is a thin layer of healthy flesh about 1/32 inch thick, immediately under the skin. Under this lies a starchy deposit which is gray and which extends beyond what externally appears to be the boundary of the spot. In cross section the deposit

is lens shaped (doubly convex). If one cuts near the edge of the spot, the deposit can be pried out so as to leave a smooth, clean cavity. The surface of the deposit is inclined to be brownish yellow and corrugated and consequently the spot in cross section shows a grayish mass surrounded by a brown border which at the top is separated from the skin by a thin layer of healthy tissue. Cultures of these spots have demonstrated that the dead tissues are sterile. If external conditions are wet infection usually sets in and the thin healthy line of tissue disappears, the entire deposit becomes brown and the whole region becomes soft and discolored. Fusarium rot, Sclerotium rot, and slimy soft rot usually invade the spots."

Hollow heart (physiological) was observed in New York, Wisconsin, and Washington. The following comments regarding it are interesting:

"F. S. Kinsey, Supervising Inspector in Washington and Oregon, advises that some hollow-heart is being found this season in Yakima Valley potatoes. Opinions differ as to whether this condition is unusually prevalent compared with previous years, but it seems to be certain that very few (if any) shipments can be certified as U. S. No. 1 grade.

"The first killing frost in the Valley did not occur until October 27, the latest date on record in that section. An opinion prevails locally that too-long a growing period is largely responsible for the production of hollow-heart potatoes."

"Robert Bier, superivising the shipping-point inspection of potatoes in western New York, writes of the prevalence of a certain amount of hollow heart. He says that the local inspectors have found that usually a hollow heart potato has a deep depression or more growth cracks at one end. In every case, the pronounced depression is evident. Upon russet stock it is easy to determine this defect, but upon round white stock these outward indications sometimes fail."

(U. S. Bur. Agr. Econ. Fruit & Veg. Div. Letter. Nov. 9, 1922)

An internal brown spot (cause undetermined) was found in South Carolina, Oregon and Washington. Barss, in Oregon, adds the following information:

"Mr. E. R. Jackman, inspector for potato certification, reports a serious potato trouble in which brown spots are present in the interior of the tuber as present in Malheur County. Many fields were graded down because of this and rather heavy financial loss resulted in some cases. It appeared to him more abundant in crops from certain lots of seed."

Black heart (physiological) was reported from Massachusetts, New York, Virginia and Wisconsin. No doubt the trouble was as widespread as was the shipping and storing of tubers. Bennett, J. P. and E. T. Bartholomew.((Abstract) Phytopath. 12: 443. September 1922) give the following information concerning black heart of potato:

"The temperature-time-oxygen relation in the production of blackheart appears to be fairly definite. Between 40° C. and 50° C. decreasing temperature increased the period of exposure required to induce blackheart from eight to seventy-seven days; temperature below 5° C. decreased this period. At temperatures below 35° C. blackheart did not occur until practically complete exhaustion of the oxygen in the chamber; with increase of temperature above 30° C. an increasing amount of oxygen remained at the time of appearance of blackheart. Injury leading to the development of blackheart appears to be due to anaerobic processes in the tissues. At temperatures at which exhaustion of oxygen from the chamber precedes the appearance of blackheart, the injury may appear in any part of the tuber; at higher temperatures it usually occurs centrally."

Drouth injury was found in Ohio, Indiana, lower Michigan, Idaho and Washington. H. G. MacMillan gives the following facts concerning weather relations to potatoes (Phytopath. 12: 445. September 1922):

"Temperature and factors influencing temperature appear to affect the potato yield in Colorado. A critical study of meteorological factors and potato production indicates that temperature for at least six months prior to planting is reflected in the condition of the crop and the yield. Summer temperatures have much less effect....."

Reference: Bellair, Georges: Observations sur la résistance de quelques variétés de pommes de terre à la sècheresse. Jour. Soc. Nat. Hort. France 23: 197-199. May 1922.

Heat necrosis resulting from high temperatures was reported from Idaho by L. G. Schultz.

Hail injury did some damage in western New York and in northwestern Minnesota.

Freezing injury is discussed by R. C. Wright and George F. Taylor in U. S. Dept. Agr. Bul. 916. 1921, who add the following:

"The results of a study of freezing injury to 7 commercial Irish potato varieties indicate that potatoes can be undercooled several degrees below their true freezing point without freezing injury, provided there is no ice formation within the tissue. When potatoes are thus undercooled, a more or less slight jar is liable to cause freezing or ice formation. When freezing commences in an undercooled potato, the temperature quickly rises to its true freezing point and remains there for a varying length of time, depending upon the surrounding temperature. Some varieties seem to freeze more readily than others when undercooled."

Lightning injury was observed in New York, New Jersey, Pennsylvania, Minnesota, and Wisconsin. The very characteristic spots in the fields are familiar to most growers and pathologists.

Spray injury caused by Paris green was reported only from Minnesota, but is present in every state where Paris green is used.

Fertilizer burning was responsible for some poor stands of potatoes on Long Island. (H. C. O'Dell) Reference: Brown, B. E. Effect of borax in fertilizer on the growth and yield of potatoes. U. S. Dept. Agr. Bul. 998. July 3, 1922.

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DISEASES OF TOMATO

Leaf spot caused by Septoria lycopersici Speg.

The reports each year show that the area comprising New Jersey, Maryland, Delaware, West Virginia, Virginia, Kentucky, Tennessee, North and South Carolina,

Ohio, and Indiana suffers great losses because of leaf spot. The year 1922 was in general no exception in this respect.

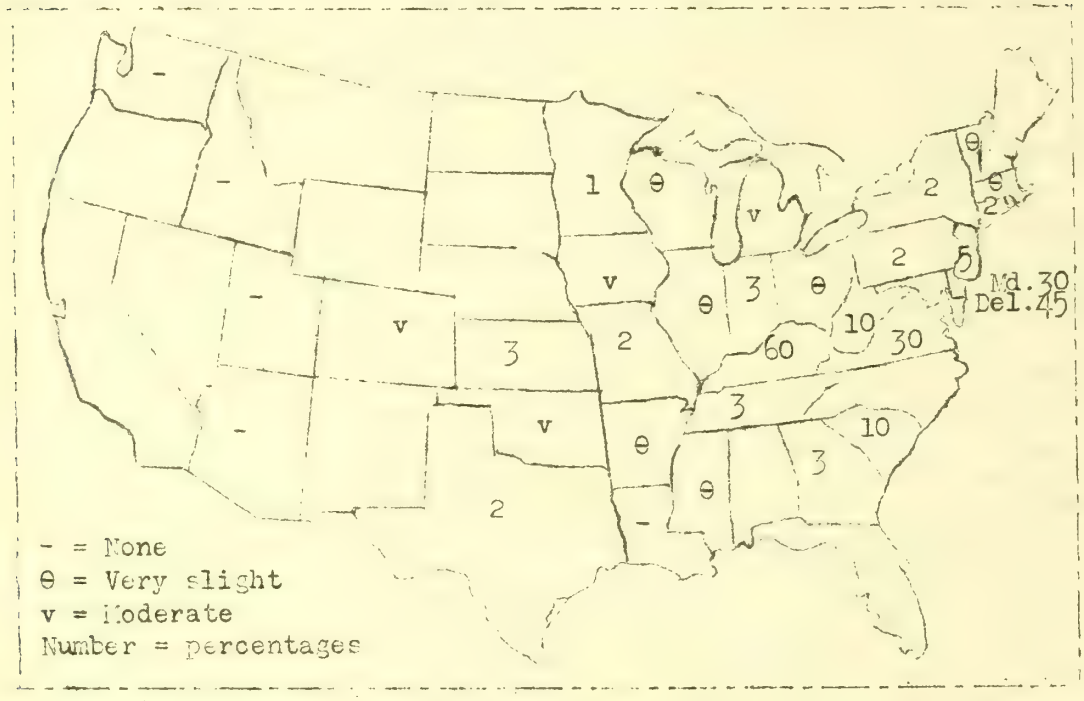

Fig. 5. Estimated losses from leaf spot in the United States in 1922.

Massachusetts: Of comparatively rare occurrence out-of-doors. First observed several years ago in greenhouse. (Osmun)

Virginia: Tomatoes in home garden at Bedford were almost completely defoliated on July 14. (Fromme)

Indiana: Serious factor in gardens and canning crop. Worse in southern half of state, especially extreme southern end; but prevalent everywhere. Noted very destructive in Marion and Gibson Counties in August. Defoliation worse on poor soils in Gibson County. (Gardner)

(See also Plant Disease Bulletin 6: 83-84, 91-92, 127. 1922)

Weather relations

Following are a few reports given by collaborators regarding weather relations to Septoria:

New Jersey: Moisture normal during infective period - heavy dews. Warm days and cool nights. (Poole)

Delaware: Heavy rains in July very favorable to prevalence. (Adams)

Maryland: Eastern half of state wet during summer. (Temple & Jehle)

West Virginia: Wet spring and early summer; cold spring.

Arkansas: Weather dry and hot. (Elliott)

Indiana: Drouth checked spread of disease. High temperature favorable. (Gardner)

Michigan: Checked in southern Michigan by dry weather. (Nelson)

Table 21. Dates of earliest appearance of tomato leaf spot in the United States in 1922.

Date	Place	Date	Place
May 19	Terre Haute, Indiana	July 20	New Castle, Delaware
June 14	Gloucester County, New Jersey	July 21	Chautauqua County, New York
June 20	Clinton County, Illinois	July 24	Stevens County, Minnesota
July 6	Boonville, Missouri	July	Fort Collins, Colorado
July 20	Madison, Wisconsin	Sept. 10	Vermont

Control measures

There is a general agreement that spraying with Bordeaux mixture and fish-oil soap gives excellent results. The control obtained by dusting has not been the same in all cases.

New Jersey: This disease has been very serious during the past three years. Treatment for control is practiced in a few sections of the state. Very good control has been obtained with 4-4-50 Bordeaux plus 1-1/2 lbs. fish oil soap. (Poole)

Delaware: Copper dust gave promising results in two fields. (Adams)

Kentucky: Defoliation reduces set and causes burning of fruit. Five dustings on each of four plantings of tomatoes with Bordeaux gave no appreciable control of leaf spot. (Valleau)

Indiana: H. D. Brown reports control in Washington County by spraying the plant beds. Field loss reduced by fertilizer and manure. (Gardner)

Michigan: Effectively controlled by Bordeaux plus resin-fish-oil soap. (Nelson)

Fusarium wilt caused by Fusarium lycopersici Sacc.

According to collaborators' estimates, serious losses of tomatoes due to wilt are confined, in 1922, mostly to states bordering the lower Mississippi and Ohio Rivers. In addition there are moderately heavy losses in Kansas, Texas, South Carolina and the Chautauqua district of New York.

New York: Rather general, especially in the Chautauqua tomato district. (Chupp)

New Jersey: In Gloucester, Camden, and Burlington Counties also

scattered in other counties. (Poole)

Maryland: Occurred in eastern half of state. (Temple & Jehle)

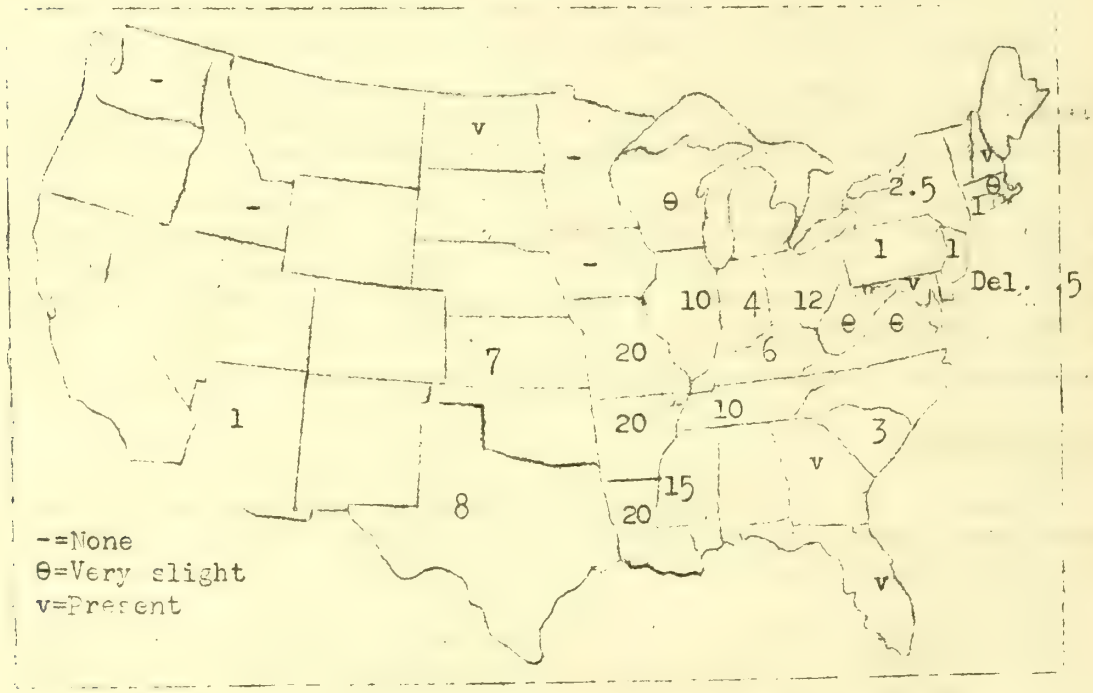

Fig. 6. Severity of Fusarium wilt in the United States in 1922.

Virginia: General in Essex County also reported from Richmond. (Fromme)

West Virginia: Rather unimportant. Found locally, mostly in Brooke County. Some Marvel Wilt resistant proved very satisfactory. (Department Plant Pathology)

Florida: This disease was prevalent all over the state this past season. (Burger, August 1922)

Mississippi: General in most every garden in state where resistant varieties are not used. Resistant varieties,- viz, Pritchard and Edgerton selections, continue to give good satisfaction, and many gardeners by using them are able to grow good crop on badly infected soil. (Neal)

Texas: Very prevalent. Almost epidemic, 15% loss. (Taubenhaus)

Indiana: State wide. Some districts still free from wilt, such as Orange and Washington Counties. (Gardner)

Illinois: Most important disease from commercial standpoint. (Anderson and Tehon)

Wisconsin: A few scattering plants seen and others reported. Of little importance in Wisconsin. (Vaughan)

(See also Plant Disease Bulletin 6: 60, 83, 92, 128. 1922)

The most favorable weather conditions according to reports are drouth and high temperature.

Missouri: In districts affected by drouth very severe. (Maneval)

Indiana: Drouth favorable. Hot July, August, September favorable. (Gardner)

Table 22. Dates of earliest appearance of Fusarium wilt in 1922.

Date	Place	Date	Place
April	Fort Smith, Arkansas	June	Burlington Co., N. J.
May 16	Louisiana	July 13	Hamilton County, Ohio
May 18	A. & M. College, Mississippi	July 22	Jefferson County, Ill.
May 24	Indianapolis, Indiana	July	Seaford, Delaware
May 29	Columbia, South Carolina	Aug. 4	New Haven, Connecticut
June 13	Crawford, Kansas	Aug. 19	Mandan, North Dakota
June 15	Missouri		

Varietal susceptibility

The ideal goal to be sought in the control of diseases is the procuring of immune varieties. Even though the breeding work has only begun wonderful results have been obtained with such vegetables as cabbage, beans, watermelon and others. Some exceptionally good work has been done also with tomatoes, and according to the reports, the selected varieties are proving entirely satisfactory.

New Jersey: Observed on Bonny Best, Baltimore, Earliana, and Stone. (Poole)

West Virginia: Some Marvel wilt-resistant proved very satisfactory.

Kentucky: Marvel seemed to be resistant and satisfactory in other ways in greenhouse. (Valleau & Gardner)

Mississippi: Resistant varieties, viz., Pritchard and Edgerton selections continue to give good satisfaction. Many gardners by using them are able to grow good crops on badly infested soil. (Neal)

Louisiana: Louisiana resistant varieties very successful. (Edgerton)

Arkansas: Norton and Louisiana Red and some other selections resistant. (Elliott)

Indiana: Large acreages grown for the Heinz Company in Gibson County are being infested with wilt by use of plants from Henderson, Kentucky. Columbia, Norton and Norduke varieties showed resistance, as compared with Greater Baltimore, although none were entirely free from wilt. (Gardner)

Illinois: Resistant varieties developed by the Dept. Hort. held up well again this year. (Anderson and Tehon)

Missouri: One to ten percent of crop injured. Globe more resistant than Stone, Ponderosa, Bonny Best and John Baer, the common varieties. Data by J. T. Rosa. (Maneval)

Resistant varieties from U. S. D. A.; Norton, Columbia, Marvel all showed fair resistance but quality of first not uniform nor very good. Data by E. M. Page. (Maneval)

Control measures

Wilt being caused by a soil organism, resistant varieties are the only feasible means of control. Soil disinfection and rotation may also be practiced to a limited extent.

Indiana: In greenhouses, bringing in new soil, changing locations of houses failed to control. In one new house, disease was introduced with transplants. In canning crop, wilt is usually associated with the use of southern grown plants. At LaFayette evidence was obtained that most of the soil infestation disappeared after four years without tomatoes, but not all,- one case of wilt occurred. (Gardner)

References

Norduke, a new variety of wilt-resistant tomatoes. U. S. Dept. Agr. Clip Sheet 1921. Feb. 20, 1922.

"In the course of work on the selection of tomatoes that will resist the wilt disease, which causes a large annual loss in the tomato-canning States, the United States Department of Agriculture has developed a variety called Norduke, similar to Stone, but highly resistant to wilt. Four other wilt-resistant varieties have already been produced, known as the Marvel, which is a medium early tomato selected from Merveille des Marchés, bearing a heavy yield of large, smooth, red fruit; the Norton selected from Stone, producing a heavy yield of large, smooth solid red fruit, which ripens slowly, and therefore ships well; and Columbia and Arlington, medium late varieties, selected from Greater Baltimore.

Pollock, N. A. R. Some notes on Fusarium in the tomato plant in north Queensland. Queensl. Agr. Jour. 18: 10-12. July 1922.

Infection probably occurs most frequently through damaged roots. Dipping in a solution of one part $CuSO_4$ to 500 parts water when transplanting, and watering with the same or a weaker solution did not give complete control, but it was noted that treated plants were longer in developing the disease.

Pritchard, Fred J. Development of wilt resistant tomatoes. U. S. Dept. Agr. Bul. 1015: 18. 1922.

"The characteristics and distribution of the disease, source of infection, and persistence of the fungus in the soil are discussed.....The Marvel, Columbia, Norton and

Arlington varieties developed by the author; and Louisiana Red, Louisiana Pink, and Tennessee A 16-2, proved resistant to wilt and suitable for commercial purposes." (Abst. in Bot. Absts. 11: Entry 2893. 1922)

Western yellow blight (cause not definitely determined)

Western yellow blight is reported from Idaho (5% loss), Utah (1% loss), Oregon and Washington. The cause, judging from reports, is not definitely known. From Washington it is given as Corticium vagum; from Oregon, Fusarium et al ?; and from Idaho, Fusarium sp.

Oregon: Damage most severe in sections east of the Cascade Mountains from Columbia Basin to Klamath County. In the Wasco County sections were reported as less severe than usual in most cases. Supt. Dean of Umatilla Branch Station at Hermiston says it is not serious "where crops have some shade and soil is fertilized. Damage otherwise 50 to 100%." (Barss)

Washington: Becoming more prevalent about Pullman and vicinity but not as prevalent as in other years. 1% loss. (Dana)

Reference: Heald, F. D. (Washington Col. Sta. Bul. 167: 38-43. 1922. The results of continued observations on the western blight or yellows of tomato are given in which the author reports the failure to secure cultures of Rhizoctonia. Isolations made from diseased material showed that both Rhizoctonia and Fusarium are present, and the possibility of the two fungi acting together to produce the disease is being investigated.

Early blight and nailhead spot caused by Macrosporium spp.

Early blight and nailhead spot was less severe in nearly all states excepting New York, where the Alternaria fruit spot became so prevalent that canning companies in the Ontario lake district refused to accept the tomatoes which the farmers were delivering. Below the surface spot on the fruit was a blackened streak extending through the flesh and making the tomatoes unfit for anything but catsup.

New York: Leaf spot, and particularly a fruit spot, wherever tomatoes are grown. So great was the loss that the Canners' Association has asked for the services of a pathologist during the growing season next year.

Jefferson County: Serious infection this year and last. (Chupp)

New Jersey: General, of most importance in Burlington, Camden and Gloucester Counties. Wet in early season. The mold is associated with sun scald. Infected fruit rots if conditions are favorable to the organism. Usually the infected fruit dries up on the field, where it is left by the pickers. (Poole)

West Virginia: Generally later in appearance and less destructive than last year on early crop. Very little fruit injury. More common and more destructive on the early crop than the leaf spot except in few instances. (Sherwood)

Indiana: Mainly as a fruit spot; also as collar rot. An Alternaria fruit spot serious late in season and assumed to be due to A. solani.

Spots oval or circular, sunken, smooth, with an even margin, and black or brown in color. When very small margin may be lobed usually on late-maturing fruits. Alternaira isolated repeatedly.

Collar-rot, probably due to this fungus, occurred in same locality where it occurred last year - Hancock County, on June 26, and is attributed to plant bed infection of seedlings. (Rosenbaum, J. A. Macrosporium foot-rot of tomato. Phytopath. 10: 415-522. 1920.) (Gardner)

Mississippi: Defoliation of plants, especially early varieties,- spotted. Mostly in southern counties. Several fields in Hinds, Copiah, Harrison, and Pearl River Counties were rather seriously affected, causing defoliation. (Neal)

Texas: This disease was found in cold frames of tomato plants and in sweet potato beds in east Texas. It is similar to the one described by Rosenbaum and Pritchard on the tomato. From isolation and infection studies of the Texas material, it was found that Macrosporium solani was the only organism present in both the sweet potato and tomato material. Little difficulty was experienced in infecting healthy plants of both hosts with this fungus. (Taubenhaus)

Table 23. Prevalence of early blight and nailhead spot in the United States in 1922.

State	% loss	State	% loss	State	% loss
New Hampshire	Trace	West Virginia	10	Ohio	Not serious
Massachusetts	"	Kentucky	0	Indiana	Present
Connecticut	.5	Tennessee	2	Illinois	4
New York	10	Florida	Present	Wisconsin	Trace
New Jersey	3	Mississippi	3	Minnesota	"
Delaware	General	Louisiana	1	Iowa	Present
Maryland	Trace	Texas	1	Kansas	"
Virginia	2	Arkansas	Trace	Idaho	0
				Washington	0

Table 24. Dates of earliest appearance of early blight and nailhead spot in 1922.

Date	Place	Date	Place
May	Gloucester County, New Jersey	July 28	Riley, Kansas
June 1	Wood County, West Virginia	July	Tompkins County, New York
June 1	Summit County, Ohio	Aug. 4	Seaford, Delaware
June 10	Jackson, Mississippi	Oct. 4	Marion County, Indiana
June 17	Washington County, Illinois		

Varietal susceptibility

No definite information about varietal susceptibility was submitted.

New York: Ponderosas and Nortons transplanted side by side on same day. Ponderosas almost defoliated, while Nortons were almost free. (Chupp)

Mosaic

(See also mosaic of potato, especially references)

Mosaic of tomatoes is of considerable importance in many areas, both in the field and the greenhouses.

New Jersey: Aphis are no doubt closely related to the dissemination of this disease in New Jersey. The "streak" and filiform conditions are considered to be related. The latter two are serious in greenhouses, especially on winter grown tomatoes. As high as 95% loss was observed in several greenhouses in December. (Poole)

Indiana: Yield reduced. Fruit lesions noted both in greenhouse and field crops. Worse in central part of state. (Gardner)

Illinois: Throughout the state, especially common in greenhouse. (Anderson and Tehon)

Missouri: Severe infections in greenhouses under forcing conditions. General in several localities, 2 to 25% of crop injured. Data by J. T. Rosa. (Maneval)

Kansas: Only fairly common and causing but little damage, in spite of many plants showing mosaic symptoms. (R. P. White)

Oregon: Reported as slight from Willamette Valley and Umpqua Valley. (Barss)

(See also Plant Disease Bulletin 6: 59, 84, 112, 128. 1922)

Table 25. Prevalence and importance of tomato mosaic in 1922, according to collaborators.

State	% loss	State	% loss	State	% loss
Connecticut	Present	West Virginia	Slight	Michigan	Not extensive
New York	10	Louisiana	5-10	Minnesota	1
New Jersey	16	Arkansas	Trace	Iowa	Very important
Pennsylvania	Very prevalent	Ohio	Not marked	Missouri	2-25
Delaware	5	Indiana	2	Kansas	Present
Maryland	Trace	Illinois	Trace	Idaho	More than usual
				Oregon	Present

Table 26. Dates of earliest appearance of mosaic during 1922.

Date	Place	Date	Place
May 3	Cuyahoga County, Ohio	June 8	Missouri
May 10	Cass County, Indiana	July 24	Cloud, Kansas
May 16	Louisiana	July 27	Branford, Connecticut
May 22	Ramsey County, Minnesota	Aug. 4	Seaford, Delaware
May	Gloucester County, New Jersey	Aug. 29	Kings County, New York

Control measures

In tomato mosaic it has been proved definitely that weeds are harborers of the virus. The question arises as to whether more weeds will not be found associated with different diseases, the control of which will depend upon the eradication of the weed hosts.

Indiana: A field control experiment in which an active campaign was waged against weed carriers resulted as follows: Aug. 29, .43% mosaic in field 1 (ten acres) and 1.8% in field 2 (5 acres) as compared with 14.2% in field 3 (30 acres). Fields 1 and 2 were weeded, field 3 was check. Abundant evidence against horse nettle as well as ground cherry, as carriers of mosaic. (Gardner)

Minnesota: Heavily infected Solanum nigrum associated with diseased tomatoes. (Section of Plant Pathology)

Idaho: Important in some sections. Found on Solanum nigrum in several tomato fields. (Hungerford)

References

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Gardner, M. W. and J. B. Kendrick. Indiana Sta. Bul. 261: 24 p. 1922.
A number of annual and perennial solanaceous plants have been found that are subject to mosaic. Of these the perennial species are considered of most importance on account of the wintering over of the rootstocks. Several species of ground cherry (Physalis spp.) and the horse nettle (Solanum carolinense) are common weeds in tomato fields in Indiana, and their eradication, together with any related species, is recommended. Suggestions are also made for seed bed and greenhouse control of this disease. (Abstract Exp. Sta. Rec. 47. Oct. 1922)

_____ Overwintering of tomato mosaic. Bot. Gaz. 73: 469-485. June 1922.

Blossom end rot (non-parasitic)

Not many definite estimates were given of the losses incurred through blossom end rot but the average loss was evidently not so high as last year.

The cause is considered as ecological, but the collaborators are not all agreed as to the exact conditions which produce the disease.

New York: Where Ponderosas were defoliated with Alternaria there was no blossom end rot, but Nortons free from Alternaria and growing on adjoining rows fruit damaged 30 to 40%. (Chupp)

New Jersey: The disease has been observed on Stone, Earliana, Bonny Best, and Baltimore varieties. It is most severe in greenhouses, where from 20 to 50 per cent loss occurred. (Poole)

Virginia: Frequent rains prevalent, severe injury. (Fromme)

West Virginia: About usual amount seen and very generally distributed over the state. (Sherwood)

Georgia: Very common and caused serious loss; in many instances from 50 to 80% of the early crop. (McHatton)

Mississippi: All varieties appear to be affected to about the same degree. Blossom end rot is second in importance to wilt. (Neal)

Oregon: General but not apparently as severe as usual perhaps due to the fact that dry weather prevailed from the time the plants were set out thus forestalling an unbalanced condition later. (Barss)

Table 27. Prevalence of blossom end rot of tomatoes in 1922.

State	% loss	State	% loss	State	% loss
Vermont	Slight	Mississippi	10-12	Michigan	Present
New York	2-3	Texas	Present	Wisconsin	Minor
New Jersey	Common	Arkansas	4	Minnesota	Slight
Ohio	Slight	Indiana	Severe	Iowa	Present
Virginia	Slight		under	North Dakota	Severe locally
West Virginia	2		glass	Idaho	Present
South Carolina	6	Illinois	1	Washington	Two reports
Georgia	Serious			Oregon	General

Table 28. Dates of earliest appearance of blossom end rot in 1922.

Date	Place	Date	Place
May 27	A. & M. College, Mississippi	August	Tompkins County, New York
July 6	Calhoun, South Carolina	Sept. 1	Madison, Wisconsin
July 7	Ramsey County, Minnesota	Sept. 15	Vermont
Aug. 15	Page, North Dakota	Oct. 8.	Tuscarawas County, Ohio

Reference

Bewley, W. Tomato diseases. Jour. Roy. Hort. Soc. 47: 169-174. Sept. 1922.

Leaf mold caused by Cladosporium fulvum Cke.

Leaf mold is not an important disease, although in the greenhouse it may become troublesome if the humidity of the atmosphere becomes too high. The disease was reported from Massachusetts, Connecticut, New York, New Jersey, Kentucky, Florida, Louisiana, Ohio, Indiana, Iowa, and Kansas.

New Jersey: This disease has been common on greenhouse grown tomatoes in this state for several years. It is especially abundant on tomatoes maturing in October and November. Only slight infections have been observed in the field. (Poole)

Florida: There are 24 acres under cloth and slats. The plants were set about middle of August after tobacco. They have been dusted once a week with Paris green (1 to 3 lbs. per acre). The mold has appeared within the last two weeks and will cause damage if the frost does not kill the plants during the next month. (W. B. Tisdale, October 24, 1922)

Louisiana: Common and in a few localities very severe. In the worst infected region, one patch was practically killed. In most sections of the state, however, the leaf mold was only of minor importance. (Edgerton)

Reference

Bewley, W. Tomato diseases. Jour. Roy. Hort. Soc. 47: 169-174. Sept. 1922.

Bacterial blight caused by Bacterium solanacearum EFS

In none of the eleven states from which bacterial blight was reported was it serious. In Maryland it was first observed in Wicomico County, July 28. In one field the infected plants averaged 25%. The average loss for the state was a trace. In Virginia a trace, and in West Virginia two fields were observed in Barbour County with about 33-1/3% loss. In South Carolina it was fairly common, being observed first June 3; in Georgia general and serious in home gardens; in Florida it was reported from several localities; in Mississippi it was not observed; in Louisiana, only scattered infections (1% loss), the first of which were observed May 22; in Texas, Taubenhaus reports only a trace; in Indiana, it being found serious in one greenhouse, isolation and inoculation experiments were conducted which proved the pathogenicity of the organism in question; and in Arizona 1% loss was recorded.

Rootknot caused by Heterodera radicicola (Greef) Mül.

Root knot is reported from New Jersey, West Virginia, South Carolina, Mississippi, Louisiana, Texas, Ohio, Indiana, Kansas, and Washington. Percentages of loss are 5% in South Carolina, 1% in Mississippi and Texas, and 5 to 10% in Louisiana. Following are the comments by collaborators: New Jersey (Poole) "No record was obtained of infestation of plants in field. Heavy

losses amounting to 50% have been observed in a few greenhouses." Mississippi (Neal) "Stunted plants, poor or no yield. One report this season from Waynesboro causing serious loss in a three-acre field. Ohio (Thomas) "Found only in greenhouses, successfully controlled by steam sterilization. Indiana (Gardner) "Serious in greenhouses; occasional in field. H. D. Brown is publishing a Purdue Station Bulletin on greenhouse soil sterilization with steam pipes and tile to control nematodes." Kansas (White) "Nematodes seem to be quite prevalent in Reno County, cause considerable damage. Trouble has been had in the greenhouse as well as the field with nematodes."

Reference

Sandground, J. A study of the life-history and methods of control of the root gall nematode, Heterodera radicicola (Greef) Müll. in South Africa. So. Afr. Jour. Sci. 18: 399-418. 1922.

Other diseases - those affecting stems

Fuligo septica L., a slime mould, smothered plants in the seedbed in Washington County, Ohio.

Winter blight, stripe or streak (cause unknown) has been reported from New Jersey, New York, and Kansas. In New Jersey Poole says: "A diseased plant is occasionally found in large fields. It is serious in both fall and spring crops of tomatoes in greenhouses. As high as 95% of plants in a few greenhouses were affected with the disease." The following references are given:

W. Bewley. Tomato diseases. Jour. Royal Hort. Soc. 47: 169-174. 1922.
Paine, S. G. and M. S. Lacey. Studies in bacteriosis VII. Comparison of the "stripe disease" with the "Grand Rapids disease" of tomato. Ann. Appl. Biol. 9: 210-212. 1922

Bacterial wilt caused by Aplanobacter michiganense EFS was reported July 24 from Grand Rapids, Michigan. It is commonly the cause of wilted plants in Grand Rapids greenhouses.

Collar blight caused by Rhizoctonia solani Kühn was found very prevalent in seed beds in Delaware. In New Jersey, Rhizoctonia caused a damping off of seedlings in hot beds. The loss was slight. Bothcollar rot and damping off were found in New York.

Leaf roll (cause unknown) was very severe from about the middle of July to the first of August at Manhattan, Kansas, according to a report from R. P. White.

Damping off of seedlings. Bewley (Bewley, W. Jour. Roy. Hort. Soc. 47: 169-174. Sept. 1922.) says: "This disease is caused by a number of different fungi, but mainly those belonging to the genus Phytophthora and especially P cryptogea Pethybridge and P. parasitica Dastur."

Damping off attributed to Pythium debaryanum Hesse was reported from New Hampshire.

Sclerotium blight caused by Sclerotium rolfsii Sacc. was observed June 15 in one field in South Carolina.

Hollow stem caused by drouth and spindling transplants was serious locally in Indiana. According to Gardner the growers often mistake it for Fusarium wilt.

Frost injury - early plantings of tomatoes were badly injured in the Imperial Valley, California (C. L. Brown, Bur. Mark. & Crop Est., Div. Letter 3: 31. 1922)

Lightning injury - found by Gardner, July 7, at LaFayette, Indiana.

Water injury - In Caroline and Dorchester Counties, Maryland, tomatoes were greatly damaged by floods and heavy rains. Losses estimated at 50 to 75% of crops. Septoria came on badly afterwards.

Other diseases - those affecting fruit or blossoms

Late blight caused by Phytophthora infestans (Mont.) De Bary. The disease was reported from only four states in 1922. In New York and New Jersey there were only traces of the disease. In Virginia there was much loss on the higher altitudes of the southwest section, a maximum of 75% injury being found in some fields. In West Virginia it started late, so that in many cases it was checked by dry hot weather. The estimated loss was 5%. None was found in Ohio. It was interesting to note that in Virginia copper-lime dust gave good control.

Phoma fruit rot caused by Phoma destructiva Plowr. was found in New York, New Jersey, Virginia, Arkansas, Ohio and Iowa. In New York it was found on cracked fruit, destroying 2 to 3%; and in Arkansas it was severe, the maximum rot found in any one field being 5%. In the other states the loss was only slight. Ohio (Thomas) - "Fruit rot was found in Washington County this year. This disease had not been previously noted to have occurred in the state. Only slight loss resulted this season." Arkansas (Elliott) - "Common, causing considerable rot." Virginia (Fromme) - "Common but of relatively minor importance." New Jersey (Poole) - "Only few specimens of serious rot found in Burlington County and at Experiment Station." (Reference: Link, G. K. K. and F. C. Meier. Phoma rot of tomatoes. U. S. Dept. Agr. Dept. Circ. 219. 1922.)

Anthracnose caused by Colletotrichum phomoides (Sacc.) Chester. - was observed in New Jersey, Indiana and Kansas. Poole of New Jersey states that "The disease caused 25% loss of ripe fruit in some fields of Bonny Best tomatoes. It was found only on ripe fruit. The loss for the state was slight." Indiana (Gardner) - "Abundant in canning factory, Marion County, 10-4-22, and in fields. It is a rot of ripe fruit." Kansas (White) - "The disease is present to a slight extent in the tomato project work here. It has not been observed elsewhere."

Buck-eye rot caused by Phytophthora terrestria Sherbakoff was present at Hazelhurst, Mississippi in June. It was doing slight damage. Indiana (Gardner) - "Serious in greenhouses where it has previously occurred. See Kendrick, James B. Phytophthora rot of tomato, eggplant and pepper. Proc. Ind. Acad. Sci. 1922." Other reference: Bewley, W. Tomato diseases. Jour. Royal Hort. Soc. 47: 169-174. 1922.

Bacterial spot caused by Bacterium vesicatorium Doidge did some damage in Indiana, Michigan and Kansas.

Indiana: Seed disinfection seems to have controlled this disease in the canning crop. Only a very few cases were noted in canning factory belts, Marion County, October 14. (Gardner)

Michigan: At Michigan Agricultural College in Horticultural Department variety test. Found only in Earliana variety; 16 different plantings, all from different seedsmen. May have been controlled by spray or else checked by hot dry weather, but gave no advance in attack after July 18. (Division of Botany)

Kansas: A fruit spot on tomatoes resembling the scab spot described by Gardner and Kendrick appeared in this state for the first time this year, and caused considerable damage. A yellow bacterium was isolated, which is listed temporarily as B. vesicatorium. The description of the disease as given by Gardner and Kendrick fits the Kansas specimens. Cultures are being sent to Gardner and Kendrick for identification. Material from Cloud and Reno Counties. (White)

Soft rot caused by Oidium oospora lactis Poole was found in Burlington County, New Jersey. This disease was very serious in several fields last year near Riverton. The fungus enters the cracked tomatoes and causes rapid decay. There were very few cracked fruit this year. (Poole, R. F. A new fruit rot of tomatoes. Bot. Gaz. 74: 210-214. 1922.)

Soft rot of fruit caused by Rhizopus spp. was found in New Jersey on green and ripe tomatoes which touched the ground and were shaded. The disease appeared only in Burlington County.

Bacterial soft rot - common and in general the most important fruit rot in Virginia. (Fromme)

Blossom drop (physiological) was observed in West Virginia, Texas, Ohio and Kansas.

West Virginia: More this year than usual. One very severe case observed in Marion County on an unknown variety. (Sherwood)

Ohio: This disease occurs early, chiefly in hot houses but seldom affects more than one cluster set. (Thomas)

Kansas: Reported as being severe in some home gardens but from no large commercial grower. (White)

Fruit spots (cause unknown) were reported from Kansas and Washington.

Sunscald on fruit was severe both in West Virginia and Indiana. It was the result in most cases of plant defoliation due to Septoria blight.

Cat face (malformation or marking of blossom end) of fruit and growth cracks were reported for Indiana by Gardner. There was considerable damage in the canning crop.

Two new diseases of tomato

Ramsey, G. B. Basisporium gallarum Moll. A parasite of the tomato. Bot. Gaz. 74: 325-328. 1922.

Douglas, Bruce. A new Alternaria spot of tomatoes in California. Phytopath. 12: 146-148. March 1922.

General references to tomato diseases

Anon. Wart disease attacking the tomato. Gard. Chron. III, 71: 62. Feb. 11, 1922.

"Investigations carried out by the United States Department of Agriculture have proved that tomatoes are susceptible to wart disease of potatoes. Out of twenty-eight varieties of tomatoes planted in a wart-infested garden in eastern Pennsylvania, twenty-six sorts were found to be susceptible to the disease."

Anon. Tomato spraying experiments. New Hampshire Sta. Bul. 203. 1922.

_____ Ziekten en beschadigingen van tomaten. Versl. en Meded. Plantenziektenk. Dienst Wageningen No. 26: 30. 1922.

Bewley, W. S. Report of the mycologist. Ann. Rep. Exp. & Res. Sta. Nursery & Mark. Gard. Industr. Dev. Soc. 7 (1921): 32-41. 1922. (Leafspot or anthracnose of cucumber, soft rot of the arum, tomato diseases.)

_____ Tomato diseases. Jour. Roy. Hort. Soc. 47: 169-174. September 1922. (Contains accounts of diseases of greenhouse tomatoes as grown in England, with control measures.)

Botany and plant pathology. Pennsylvania Sta. Bul. 170 (1922): 15-19, 19-20.

A winter blight of tomatoes has been described (E.S.R., 38, p. 50). Continued studies have shown the disease is seed borne, and that high humidity and unbalanced nutrition of the host plant favor its incidence. Spraying tomatoes with Bordeaux mixture for the control of Septoria leaf spot resulted in a larger total yield of fruit but not in a greater proportion of ripe fruit, due, in the author's opinion, to the shading effect of the fungicide. Brief notes are given of three bacterial diseases of tomatoes, one caused by an organism closely resembling Aplanobacter michiganense and the others due to Bacterium exitiosum and Bacillus solanacearum. (Abst. Exp. Sta. Rec. 47: Oct. 1922)

Brooks, F. T. and G. O. Searle. An investigation of some tomato diseases. Trans. Brit. Mycol. Soc. 7: 173-197. 1922.

"Various rots of tomato fruits and certain diseases of the stems of tomato plants have been investigated. These fruit rots commonly occur both on imported and upon home-grown fruit, and are caused by several different fungi about the identity of which there has been much uncertainty. The fungi isolated from rotten tomatoes have been compared with authentic cultures of certain presumably identical or closely related fungi from the United States. One of the rots is caused by Phoma destructiva, the British form of which is identical with that from America. Another is produced by a fungus which has hitherto passed in this country under the name of Mycosphaerella citrullina, but which is certainly not identical with the American fungus of that name. The British fungus which has hitherto been mistaken for this and which causes tomato stem "canker" as well as a fruit rot, appears to be identical with Diplodina lycopersici Hollos which name also replaces Phoma lycopersici Cooke. It has been considered advisable to amplify Hollos' description and the fungus is therefore named Diplodina lycopersici (Cooke) Hollos, emend. Brooks & Searle. Another pycnidial fungus, found only once as the cause of tomato rot, is associated with an Alternaria stage, and the name proposed for this fungus is Phoma alternariaceum Brooks & Searle. Finally, various strains of Gloeosporium and Colletotrichum parasitic on tomatoes have been isolated. One of these fungi is identical with the American Colletotrichum phomoides (Sacc.) Chester, and probably all of these forms are thus best grouped.

"The desirability of undertaking cultural studies of fungi belonging to such genera as Phoma, Diplodina, and Colletotrichum as an aid in the diagnosis of species, is emphasized."

Bewley, W. "Sleepy disease" of the tomato. Ann. Appl. Biol. 9: 116-134. June 1922.

Cunningham, G. H. Stem canker. New Zealand Jour. Agr. Jan. 20, 1922.

Dickson, B. T. Diseases of the potato. Sci. Agr. 2. 1922.

"It is interesting to note that the roots of tomato are susceptible to infection by Spongospora subterranea and that galls are formed similar to those on potato roots."

Harvey, R. B. and R. C. Wright. Frost injury to tomatoes. U. S. Dept. Agr. Bul. 1099. Aug. 1922.

Myers, C. E. The development of new varieties of tomatoes. Amer. Seedsm. 4: 13-15, 52, 54. March 1922.

Pape, Heinrich. Sclerotinia libertiana Fuckl. als schädling der tomatenpflanze. Gartenw. 26: 309-312. 1922.

Parker, Theodore, A. R. Long and J. S. Mitchell. Soil sterilization for tomatoes. Fruit Grow. Fruit. Flor. & Mark. Gard. 53: 631-632. April 1922.

_____ A note on soil sterilization for tomatoes. Bul. Bur. Bio-Techn. Murphy & Son 5: 134-142. March 1922.

Pritchard, F. J. and W. S. Porte. Isaria rot of tomato fruits. Phytopath. 12: 167-172. April 1922.

Riker, A. J. Some morphological responses of the host tissues to the crown-gall organism. (Abstract) Phytopath. 13: 43. Jan. 1923.

Schoevers, T. A. C. Bestrijding van tomatenziekten in Engeland. (Controlling tomato disease in England.) Verslag. en Mededeel. Plantenziektenk. Dienst Wageningen 25. 16 p. 1922.

DISEASES OF SWEET POTATO

Sweet potato certification

For some time the Northern growers of white potatoes have had their fields inspected, and the best stock certified. The results have been so satisfactory that a similar service is being put into practice for the Southern sweet potato grower. At the Atlanta meeting of the Agricultural Workers a committee consisting of various state inspectors working in cooperation with the plant pathologists took up a careful consideration of the subject of sweet potato certification with a view to making recommendations for uniform regulations on this subject.

This subject was very carefully considered and the committee expressed its opinions on the subject in the following resolutions:

"(1) Every state should adopt adequate regulations to prevent the shipment of the sweet potato weevil in potatoes or slips.

"(2) We do not think that the time is ripe for the adoption by all states of regulations making compulsory the certification of sweet potatoes or sweet potato slips as to freedom from disease as a condition of their movement interstate.

"(3) We recommend that each state provide a voluntary certification system making it possible for sweet potato growers to buy dependable seed and slips in so far as freedom from all injurious insect pests and diseases are concerned.

"(4) In our opinion a voluntary certification system as is recommended in these resolutions should have as its minimum requirements the following:

A - SEED CERTIFICATION

"(a) There should be at least one field inspection during the growing season, made with a view to detecting stem rot, mosaic and other field diseases. This inspection should be conducted systematically, beginning at one end of the field and working up and down the rows to the other end. NOT LESS than 20 minutes of thorough inspecting should be allowed for each acre.

"(b) The tubers from fields passing the first inspection should be inspected thoroughly for black rot, foot rot and other rots at least once. This inspection should be made after curing and should be delayed as late as possible. Where early inspections are made additional later inspections are desirable. The inspection should have been made so that potatoes have been inspected from every source or from all parts of the field.

"(c) As a safeguard against abuse of the certificate, the certification system should be supplemented by a registration system in which certificate holders be required to register all sales of both certified and uncertified seed made by them. All certified seed must bear a copy of certificate and all uncertified seed should be labeled as such. The registration system can be improved by a system of notifying purchasers of registrations made.

B - SLIP CERTIFICATION

"Slip certificates may be granted to plant growers who will grow nothing but certified slips. This certificate should be granted under the conditions that:

(a) nothing but certified seed be bedded,
(b) the seed be dipped
(c) the seed be bedded in soil which has never been in potatoes before, and that location of the bed be approved,
(d) tools, implements, frames, etc. be disinfected,
(e) the sales of slips be registered the same as is required of certified seed.

"C - As a condition of the issuance of seed or slips certificates an affidavit be executed setting forth the conditions under which the certificate is granted.

"D - All certificate tags be purchased from the inspector and that all of them be accounted for."

Below are given some of the methods of sweet potato certification followed in the various states:

Alabama: "The State Board of Horticulture maintains a free inspection service for sweet potatoes for seed purposes, or sweet potato slips which are to be shipped outside the state. Such shipments must bear the certification tag, which is purchased from the Board. No inspection or certification is required for sales within the state." (L. E. Miles)

Arkansas: Arkansas has a well developed system of inspection and certification. The service is conducted under their rules 45, 46, 47, 48, 50 and 54.

Application for inspection

"Rule 45. Any person growing Irish or sweet potatoes for seed may have such seed inspected by applying to the Chief Inspector on or before March 1 for the inspection of spring grown seed Irish potatoes and on or before July 15 for the inspection of seed sweet potatoes or fall grown seed Irish potatoes. Such application for inspection shall set forth (a) the location of the place where the seed is grown with reference to the direction and distance to the nearest railroad station, (b) the number of acres to be inspected, (c) the varieties of potatoes, (d) the distance between the blocks of growing seed stock and (e) such other information as the Chief Inspector may need in estimating the time required for the inspection."

Fees for inspection

"Rule 46. For the inspection of seed Irish or sweet potatoes as provided in Rule 45 the Chief Inspector shall charge fees as follows:

"(a) A fee of $5.00 to be paid at the time that the application for inspection is made.

"(b) An additional fee of $1.25 per acre, for each acre which it is desired to have certified. The latter fee to be paid before the second inspection is made.

"(c) An additional fee of $5.00 for each extra inspection which may be warranted as a result of the findings of a previous inspection.

"Applicants must furnish the inspector transportation from and to the railway station and facilities for reaching his fields of seed stock.

"Applicants may withdraw their applications for inspection by notifying the Chief Inspector within 15 days after receiving from him the report on the first inspection.

Requirements for certification

"Rule 47. All seed Irish or sweet potatoes for which certificates of inspection is desired must be inspected at least twice. (a) When the seed crop is growing and (b) at digging time, or if the Chief Inspector shall so elect, after the potatoes have been stored. Applicants must have their seed crop in a clean state of cultivation and in such condition otherwise that all plants can be easily seen by the Inspector.

"(c) Upon proper fulfillment by the grower of the seed potatoes of all requirements, prescriptions and conditions set forth in the notices issued said grower by the Chief Inspector, he shall be issued a certificate of inspection in form as hereinafter set forth in the rules of the Board."

Certification of slips

"Rule 48. The Chief Inspector may issue a certificate of inspection covering sweet potato slips to any person who shall grow his sweet potato slips from seed sweet potatoes for which a certificate of inspection was issued under the provision of Rule 46 when such seed sweet potatoes were bedded in accordance with directions furnished by the Board. Applications for a certificate under the provisions of this rule must be made to the Chief Inspector 30 days before the sweet potatoes are to be bedded, and must be accompanied by a fee of $1.00. The sweet potato slip certificate shall be in form as hereinafter set forth in the rules of the Board."

Labelling requirements

"Rule 50. Holders of certificates of inspection granted under the provisions of Rules 47 and 48 of the Board must attach to each carload, sack, hamper, basket or package of sweet or Irish potatoes or sweet potato slips covered by their certificate a tag bearing a copy of said certificate with the fac simile signature of the Chief Inspector. Said tags to be purchased at cost from Chief Inspector."

"Whenever a holder of a certificate of inspection as provided in Rules 46 and 47 shall sell or ship seed sweet or Irish potatoes or sweet potato slips which are not covered by a certificate issued by the Chief Inspector of the Arkansas State Plant Board he shall attach to every carload, sack, hamper, basket or package of such seed sweet or Irish potatoes or sweet potato slips a tag bearing, in letters not less than 1/4 in. high (24 point type), the words "Not Covered by a Certificate of Inspection from the Arkansas State Plant Board."

All sales of seed and slips must be registered

"Rule 54. Every holder of a certificate granted under the provisions of Rule 47 or 48 of the Board must file with the Chief Inspector, at the end of each week, a copy of each sale or disposition of seed or slips made by him during that week.

"Each invoice shall be made out on a separate slip (form to be provided by the Chief Inspector) and shall set forth the following information:

"(a) Name of the certificate holder disposing of the seed or slips.

"(b) Date of disposition or shipment.

"(c) Person to whom the seed or slips are disposed of.

"(d) Number of bushels, or slips, of each variety disposed of.

"(e) If seed is disposed of, whether it is certified or uncertified.

"(f) If certified seed or slips are disposed of, the number of certificate tags used for the sale or shipment must be recorded.

"Holders of certificates must also account for every certificate tag purchased from the Chief Inspector and all

unused or defaced tags must be returned to the Chief Inspector at the expiration of the certificate of which the tags bear a copy."

Aside from these rules, suitable blanks, affidavits, tags and posters are supplied. For more detailed information, address George G. Becker, Chief Inspector, Arkansas State Plant Board, Little Rock, Arkansas.

Florida: "For several years the State Plant Board has been inspecting sweet potato fields, banks, beds, etc. to determine whether or not the sweet potato weevil (Cylas formicarius) was present. A very careful survey of the state several years ago disclosed that the weevil was present in several parts of the state. Since then areas have been quarantined and the above mentioned material has not been permitted to be shipped out of the quarantined areas, except under certain conditions, such as: inspection and fumigation.

"Last year the Plant Board made an effort to have the growers in the state have their fields inspected in the fall, to determine whether or not the wilt disease of sweet potatoes was present; another inspection in the banks for the purpose of determining whether or not black rot was present, and a third inspection of the plants in the beds. The growers were not to use any stable manure from stock which had been fed on sweet potato tubers or vines. The seed was to be disinfected in a solution of bichloride of mercury before planting; old frames sprayed with a solution of formaldehyde and the bedding site approved by an inspector of the Plant Board. All this with the idea of issuing to such growers as complied with the above regulations, a certificate to ship certified seed or plants. This plan has not been taken up generally by the growers in the state so far. However, in order to ship plants into the states of Mississippi and South Carolina, these conditions must be complied with, and a few of the growers have had the necessary inspections for this purpose." (A. C. Brown)

Georgia: "The sweet potato regulations of other states, especially Mississippi and South Carolina, force us to use their methods of certification to a very large extent, because most of our growers desire to ship into other states. So far between five and six hundred potato growers have been certified." (Luther Brown)

"1. In order to prevent the introduction and spread of the sweet potato root borer (Cylas formicarius, Oliv.); also the introduction and spread of destructive diseases of the sweet potato, the importation into and movement within the State of Georgia of sweet potato plants, vines, cuttings, draws or slips shall be governed by the following regulations:

"(a) Shipments of articles enumerated in Paragraph 1 originating in other states and consigned to points in Georgia are prohibited unless accompanied by a sweet potato plant certificate issued by the Georgia State Board of Entomology. Certificates will be issued on receipt of certificates of inspection from authorized agents of their respective states.

"(b) Shipments of articles enumerated in Paragraph 1 when originating within Georgia are prohibited unless accompanied by

a sweet potato inspection certificate issued by the Georgia State Board of Entomology.

"In order to secure inspections persons, firms, and corporations growing sweet potato plants in a commercial way must register with the Georgia State Board of Entomology and make application for inspection one month previous to bedding their sweet potato tubers. Two inspections will be given, one of tubers before bedding, and a second of the draws while growing on beds. Upon the first inspection, if potatoes are found free from destructive diseases and insects a certificate will be issued to the bedder, together with information in regard to securing official shipping tags.

"Upon a second inspection, if disease shows up in beds, the diseased section will be destroyed or plant beds condemned as a whole, if, in the opinion of the inspector, the disease is beyond eradication by partial destruction of the plant beds.

Maryland: "Owing to the fact that we have no organizations to do the certifying, no seed was actually certified. However, during the season of 1921 the sweet potatoes of six sweet potato growers were found to be practically free from diseases representing 23 acres of Gold Skin, 8 acres of Big Stem, 1/5 acre of Nancy Hall and 1/10 acre of Porto Rico. During 1922 the sweet potatoes of six growers were found to be practically free from diseases representing 57 acres Big Stem, one acre Gold Skin, 1/15 acre Porto Rico and 1/2 acre Nancy Hall. The yield from these plots was approximately 300 bushels per acre. Three inspections were made, two in the field, and one during storage.

"As soon as organizations are formed with authority to certify seed, we expect to work out a system similar to our Irish potato seed work in which we will inspect the fields and seed stock of the growers and recommend it to them for certification if it comes up to the standard agreed upon by us." (Jehle)

Mississippi: "We have decided to show on the reverse side of all tags issued to be used on shipments of sweet potatoes, the exact condition in which potatoes inspected were found. We are showing the exact number of hills of stem rot and the exact percent of black rot present at the time of the storage inspection. We contemplate next season having what will be known as Class A Sweet Potato Growers, and Class B Sweet Potato Growers. Those in the first class will be the ones who have no black rot or stem rot in their potatoes, while Class B will be those having a small amount of either or both of these diseases in their potatoes. A tag is issued for out-state shipments into Mississippi. Tag on plants is same except "Plants" is stamped on it and condition is stated on reverse side of tag.

"Out-state shippers are required to comply with the same requirements as people who sell in this state." (George F. Arnold)

"For several years we have maintained a sweet potato inspection service. This service was inaugurated in order to check the further distribution of stem rot, black rot, and the sweet potato weevil, and to prevent the further introduction of these pests into the state. The results have been as good as we could have hoped for. We are certain that both stem rot and black rot have been greatly reduced.

"We would not, under any circumstances, allow a man whose property is infested with the sweet potato weevil to sell seed sweet potatoes or sweet potato plants. Therefore, we do not have any commercial potato growers in the area that is infested with the sweet potato weevil.

"I believe that the system we follow in this state is very similar to the system in Florida and Arkansas except that we make it compulsory in Mississippi. In the other states, it is entirely a voluntary matter with the growers, and they have to bear the expense of the inspection. In Mississippi the state bears the entire expense of inspection, and every person who raises sweet potatoes for planting purposes, or sweet potato plants is required to have his potatoes inspected, and a sweet potato inspection tag must accompany all sweet potatoes and sweet potato plants that are sold for planting purposes.

"At present our Quarantine Inspector, Mr. George F. Arnold, is handling the sweet potato inspection service." (R. W. Harned)

"In accordance with the provisions of Rule 53B the following requirements must be met by out-state growers in order to qualify as certified growers and obtain permit tags to cover shipments of seed sweet potatoes into Mississippi.

"1. File with the Potato Inspection Department of the State Plant Board, A. & M. College, Mississippi, a certificate from the State Entomologist or other authorized inspection official showing the approximate number of bushels and stating that the grower's seed have been found apparently free of sweet potato weevil. The certificate must show that the potatoes received two inspections as follows:

(a) While growing in the field. (b) While in storage. A statement from the state official must accompany the certificate showing exactly what diseases were found in the field inspection, the percentage or else the number of infected hills must be stated. It must also be explained about the measures undertaken to insure all seed potatoes being free from stem rot, in such cases particularly whether infected hills were dug out and a re-inspection made later. If any black rot was found, the approximate amount must be indicated.

Sweet potato plant certification requirements for Mississippi growers

In accordance with Rule 53A, the movement of sweet potato plants is regulated as follows:

1. Growers must bed nothing but certified seed.
2. The location of the beds must be approved by a State Plant Board inspector, and the beds must be placed on land that has not been planted in potatoes for at least five years. The bed must be made of soil in which sweet potatoes have never before been grown.
3. The seed to be bedded out must be inspected by an Inspector of the State Plant Board and must be hand-culled and then disinfected for ten minutes in a solution of corrosive sublimate, strength one ounce to eight gallons of water, just before being bedded out.
4. If lumber used in the construction of the beds has been previous-

ly used for the same purpose it must be thoroughly disinfected by being allowed to soak in corrosive sublimate solution, strength one ounce to eight gallons of water, for at least thirty minutes.

5. Stable manure that has been subject to infection with black rot and stem rot spores because of feeding sweet potatoes to stock must not be used in plant beds. (This is a very important point.)
6. All tools needed in the construction of plant beds, and which have previously come in contact with materials used in old beds, should be dipped in corrosive sublimate solution and may then be rinsed in water.
7. Beds must be inspected by an Inspector of the Plant Board at least once, and not more than two weeks before plants are to be removed.
8. Certificate tags will not be issued to cover shipments of plants produced in beds that have been found to be generally infected with black rot, stem rot, or other serious diseases.
9. If black rot or stem rot is found in a limited portion of a grower's bed, the infected potatoes and the soil covering them, and the soil and potatoes not less than two feet from the outermost limits of the infection in all directions must be removed from the infected bed under the supervision of an Inspector of the State Plant Board, and the spot from which soil and potatoes were removed thoroughly disinfected with corrosive sublimate solution, strength one ounce to eight gallons of water.
10. Great care should be exercised to prevent disease organisms being carried to the plant beds either on the feet of stock or any persons who may be working around the beds. There is no doubt that black rot and stem rot spores are very often spread from place to place on a property in this manner.

New Jersey: "The certification of sweet potato seed against stem rot, black rot, and scurf diseases was started in Atlantic County, New Jersey, in 1919 as an experiment by the Department of Plant Pathology. Since 1921 the State Department of Agriculture has continued the work successfully.

"The objects of the certification are to prevent further spread of the Fusaria that cause the disease and to aid growers in New Jersey and other states in locating and buying clean seed.

"Seed are certified in Atlantic, Cumberland and Ocean Counties, where the soil is not severely infected with Fusaria fungi that cause the disease. The soils of Camden, Burlington, and Gloucester Counties were so severely infected in some cases 75% or more of the plants became diseased by digging time.....

"Seed certification is voluntary, and inspections have been made free of charge to the grower. It is the plan of the State Department to make the work self supporting in the future by charging a small fee for each acre certified.

Number of growers entered - - - - - - - - - - - - - - - 48
" " " passing certification requirements - 44
Acres certified -225.7
Red Jersey - 4.25

Yellow Jersey - - - - - - - - - - - - - 80.0
Big Stem Jersey - - - - - - - - - - - - 40.0
Miscellaneous - - - - - - - - - - - - - .95
Acres entered - - - - - - - - - - - - -254

Requirements and rules for the inspection and certification of New Jersey seed sweet potatoes as adopted by the New Jersey State Department of Agriculture

- - - - - - -

1. Application for inspection and certification must be made on prescribed blanks not later than June 1.
(The grower has the privilege of increasing or decreasing the acreage by filing notice with the Bureau of Statistics and Inspection, Department of Agriculture, not later than the date of the first inspection.)
2. The application must be made to the Chief of the Bureau of Statistics and Inspection.
3. The applicant must pay fees as follows:
Two dollars ($2.00) per acre for the first five acres.
One dollar ($1.00) per acre for each additional acre.
If the acreage is less than five, the minimum fee will be ten dollars ($10.00).
4. The fee must accompany the application.
5. The applicant must sign an agreement to comply with all the rules and regulations for inspection and certification prescribed by the State Department of Agriculture.
6. Fields entered for certification must be planted with slips from seed treated before bedding.
7. The inspector will make three inspections:
(a) The first inspection about July 15 to August 1.
(b) The second inspection just previous to digging and before frost. The inspector may require the digging of some hills at this time.
(c) The third inspection about November 15 to December 1.
8. Crops will be disqualified for more than 4 percent of black rot or 5 percent of stem wilt, or for a total of 7 percent diseased of the two. Seven percent of disease at time of the first or second inspection or a total of 7 percent for the two inspections, will disqualify the field, and the third inspection will not be made. Ten per cent of scurf will disqualify the field.
9. The crop must be marketed in standard bushel hampers and each hamper must carry the prescribed tag.
10. The tags must not be used on any potatoes other than those that have been passed and certified.
11. If the field passes all inspections, the grower will be given a certificate.
Note: The certificate and tags refer only to the condition of the potatoes at time of last inspection and have no bearing whatever on rots and other undesirable conditions that may develop following that time."

South Carolina: "We have for the past several years attempted to make careful inspections of sweet potatoes both in the field and in storage, and have only permitted the sale of seed potatoes and plants

where the stock is found free from disease. We have permitted a small percentage of black rot and scurf, but have endeavored to prevent the sale of stock for seed in all cases where any other diseases are present. The Crop Pest Act of this state gives the Crop Pest Commission power to make regulations which prohibit the sale and transportation of sweet potatoes for planting unless they have been inspected by our agent and found free from disease, in which case shipping tags are issued. Our regulations with reference to sweet potatoes require that the potatoes shall be inspected in the field before frost, must be inspected in storage, and the beds must be inspected before the first crop of plants is removed." (H. W. Barre)

Tennessee: (Certification of sweet potato seed)

Section 1. ALL REQUESTS for INSPECTION must be filed in the Office of the State Entomologist ON OR BEFORE MARCH 1st. of EACH YEAR. Inspections will be made ONLY UPON WRITTEN REQUESTS.

Section 2. For bedding purposes one must use certified seed.

Section 3. All seed used for bedding stock must be culled and disinfected with a solution of corrosive sublimate. Sanitary precautions must be taken about the beds and premises.

Section 4. Sweet potatoes intended for certification must be grown in a field where no sweet potatoes were grown during the preceding three years and should not be located immediately below another field contaminated with disease during the same period, three years.

Section 5. The potatoes must be stored in houses thoroughly cleaned and disinfected.

Section 6. Every holder of the certificate must tag every package or container, irrespective of size, with a certificate tag of inspection. The use of each tag must be reported to the Office daily.

In every case where a requirement cannot be ascertained by inspection as in the case of Section 4 a sworn statement from the seed or slip producer or dealer of the same shall be required.

Inspections

For the present the inspections for certifying seed and slips shall be as follows. It shall be in the power of the inspector to make any additional inspections he deems necessary.

1. Of all plant beds in the spring from the beginning to the end of removing of the draws or slips. This is primarily to detect disease affected slips or draws.

2. Of the fields during the growing season previous to September 1. This is to detect field diseases, chiefly stem rot and foot rot.

3. During digging time. This is done chiefly to detect black rot, stem rot and foot rot.

4. Of the potato seed (at least 1% must be seen) in the storage house after January 1. This inspection is primarily for black rot.

Virginia: The first work done with the certification of sweet potatoes in Virginia was begun when I took charge of the vegetable work in July 1921. During the season of 1921 approximately fifty fields

were inspected and a large percentage of these received certificates for their stock. Since that time the work has developed steadily and at the present time we have certified sweet potatoes being produced in approximately twelve counties in the eastern part of the state. Most of this work is still confined to certain communities where we have endeavored to keep the work under close supervision in order to guard against possible trouble as a result of insufficient inspection. (A. G. Smith, Jr.)

General rules governing the certification of sweet potatoes

1. Growers desiring to produce certified potatoes must apply to the State Crop Pest Commission on or before February 1st of each year. An application blank will be furnished upon request.

2. There is no cost for inspection, but the growers will be requested to furnish transportation of the inspector to and from the nearest railroad station, or hotel, to the sweet potato fields.

3. It is recommended that all growers of certified sweet potatoes use certified seed exclusively. If certified seed are used it will be necessary for the growers to disinfect and bed them as directed by the inspector.

In case the grower does not have certified seed, he may select clean potatoes from his stock under the direction of the inspector and disinfect and bed them as for certified seed. If no disease appears during the growing and storage seasons, the grower may have his crop certified.

4. Any grower who wishes to purchase plants (draws) for the production of certified sweet potatoes, will be required to use plants from certified seed only.

5. All plantings listed for certification shall be made on land where sweet potatoes have not been grown for the preceding three years.

6. All fields listed for certification shall be inspected by an authorized representative of the State Crop Pest Commission at least twice during the growing season. The dates of the inspection to be determined by the Crop Pest Commission.

7. If the grower is producing both certified and uncertified sweet potatoes, the two crops shall be handled separately.

8. All sweet potatoes to be certified shall be harvested before the leaves are injured by frost.

9. Sweet potatoes that are to be certified shall be stored in a house approved by the inspector. Potatoes stored in banks will not be certified.

10. Certified sweet potatoes shall be graded into U. S. grade number 1 and U. S. grade number 2 at time of harvest.

11. At least two storage inspections shall be made. Additional inspections may be made if conditions justify.

12. The presence of destructive diseases or insect pests in the seed bed, field, or storage house may render the sweet potato ineligible for certification.

13. No mixing of varieties in the same container or bin will be permitted where the stock is to be certified.

14. In order to make it possible for the Crop Pest Commission to follow the shipments of certified seed stock from point to point, and maintain a high standard for certified sweet potatoes, every holder of a certificate will be required to comply with the

following regulations:

(a) Each container shall be plainly marked at time of harvest with a number or initial of the grower, and this number or initial is to be registered with the Crop Pest Commission.

(b) Holders of seed potato or plant (draw) certificates issued by the State Crop Pest Commission will bear in mind that they are required to label every shipment or sale of their seed potatoes or plants (draws) regardless of whether they are certified or not. A tag must be attached to each car load, sack, crate, hamper, basket or package of seed sweet potatoes or sweet potato plants (draws) covered by their certificate, bearing a copy of said certificate with a fac simile signature of the State Entomologist.

Whenever a holder of a certificate of inspection shall sell or ship seed sweet potatoes or sweet potato plants (draws) which are not covered by a certificate issued by the State Crop Pest Commission, he shall attach to every car load, sack, crate, hamper or package of such seed sweet potatoes or plants, a tag bearing (in letters not less than 1/4 inch high, 24 point type) the words "Not Covered by a Certificate of Inspection from the State Crop Pest Commission."

Certification work has not yet been begun in Louisiana, Texas, and North Carolina.

References

Becker, G. G. Sweet potato certification in Arkansas. Quart. Bul. St. Pl. Bd. Florida 6: 61-70. April 1922.

Bentley, G. M. and H. L. Fackler. Sweet potato certification. Tennessee State Board of Entomology Bul. 37: 1-8. 1921.

Reed, W. V. Rules and regulations governing the transportation and movement of sweet potato plants, vines, cuttings, etc., into and within the state of Georgia. Georgia State Board of Entomology Press Bul. 8: 1921.

State Plant Board. Sweet and Irish Potato Inspection Service. Arkansas State Plant Board Circ. 9: 1-12. 1920.

DISEASES

Stem rot caused by *Fusarium batatatis* Woll. & *F. hyperoxysporum* Woll.

Stem rot was present in every state where sweet potatoes are grown, and in at least half of them it was one of the major troubles. The disease was fairly uniformly distributed, although it was more serious in some areas than others. Poole in New Jersey stated that in Burlington, Gloucester and Camden Counties it was more prevalent than in Ocean, Atlantic, Mercer, Salem and Monmouth Counties.

Dates of earliest appearance have been submitted as follows: April, New Jersey; July 28, Prosperity, South Carolina; July, Wiggins, Mississippi; July 3 at Mill Spring, Missouri; June 12 at Wyandotte, Kansas; and August 1 in Warren County, Ohio.

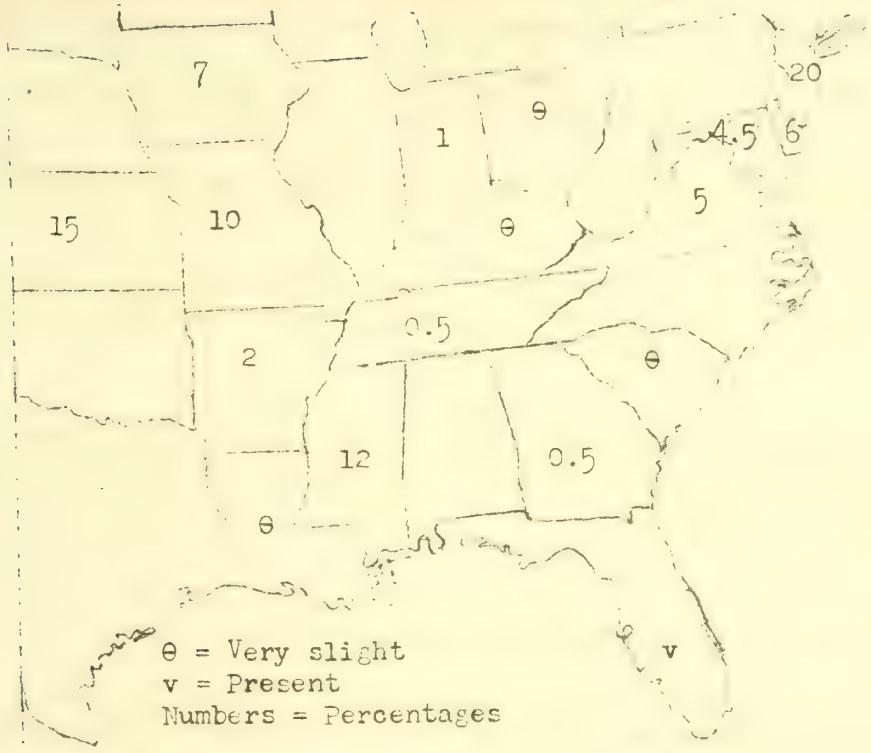

Fig. 7. Distribution and prevalence of stem rot in 1922.

(See also Plant Disease Bulletin 6: 91, 113, 151. 1922)

Varietal susceptibility

Sweet potatoes offer another possibility for selection of resistant varieties. The principal difficulty is that they blossom so sparingly that cross breeding of susceptible commercial varieties with resistant non-commercial ones is beset with many problems. Improvement must be made in great part by selection within the variety.

New Jersey: The yellow Jersey variety is most susceptible. Porto Rico, Nancy Hall and Red Jersey are also very susceptible. The big stem Jersey strains are more resistant than any of the above varieties. Triumph has been 100% resistant under two years' testing. The Dooley or Norton yam variety is also very resistant. (Poole)

Missouri: Important varieties in order of susceptibility approximately: Nancy Hall, Jersey, Nansemond, Porto Rico. (Page)

Kansas: Porto Rico shows marked resistance, but is not immune. (Stokdyk)

Control measures

Hill selection and propagation by cuttings from young healthy plants have proved popular in many of the states.

New Jersey: Slight reduction of percentage of disease has been obtained

by seed selection for freedom from the disease. Progress is being made in the study of fertilizer relation to the disease. (Poole)

Arkansas: Seed and slip certification has helped reduce the spread of the disease, and emphasized its importance. (Elliott)

Missouri: Attempts to control by seed selection, seed certification and crop rotation. (Maneval)

Kansas: Severe in some lots of seed. Many plants show infection but perfect roots. Hill selection reduced disease greatly. Growers are beginning selection. (Stokdyk)

Reference

Poole, R. F. Recent investigations on the control of three important field diseases of sweet potatoes. New Jersey Agr. Exp. Sta. Bul. 365: 39 p. April 1922.

Black rot caused by Sphaeronema fimbriatum (E. & H.) Sacc.

Black rot, as usual, was generally distributed. It seemed to be most prevalent in Kentucky and Tennessee. In some states careful control measures are generally reducing the amount of injury.

New Jersey: Common in many localities in field spreading seriously in some storage houses. It was found on Yellow Jersey, Red Jersey, Big Stem Jersey, Gold Skin, Nancy Hall, and Porto Rico varieties. (Poole)

Delaware: Wire worm injury appeared to account for considerable infection. (Adams) (See also under soft rot)

Virginia: General in seed potatoes in Norfolk and James City Counties. (Fromme)

South Carolina: Practically all county agents reporting record of this disease. (Ludwig)

Mississippi: Still general but becoming less. (Neal)

Arkansas: Fairly bad in storage, but less complaint than last year. (Elliott)

Table 29. Prevalence of, and losses from black rot in 1922.

State	% loss	State	% loss	State	% loss
New Jersey	2	South Carolina	.5	Texas	3
Delaware	.5	Georgia	2	Indiana	Trace
Maryland	1	Florida	Present	Illinois	General
Virginia	5	Mississippi	5	Iowa	5
Kentucky	15	Louisiana	1	Kansas	2
Tennessee	10	Arkansas	1	Arizona	Trace

Control measures

Seed selection, seed treatment and the use of certified seed are gradually decreasing the ravages of the fungus.

Kentucky: Seed treatment for black rot control (Mercuric chloride) was tried on 127 farms this year. The results are promising. (J. S. Gardner)

Tennessee: General in all beds in southwestern Tennessee where certified seed not used. In cases where certified seed used, beds free from black rot. (Hesler)

Kansas: Seed selection and seed treatment are controlling it satisfactorily. (Stokdyk)

References

An interesting piece of work done by J. A. Elliott was reported at the Boston Scientific Meeting.

Elliott, John A. The ascigerous stage of the sweet potato black-rot fungus. (Abstract) Phytopath. 13: 56. Jan. 1923.

"Examination of embedded and sectioned material has shown that the supposed pycnospores are ascospores which are apparently liberated within the perithecium by the early disintegration of the ascus.....The taxonomic characters place the fungus in the genus Ceratostomella and the specific name, C. fimbriata comb. nov. is therefore proposed for it."

Soft rot caused by Rhizopus spp.

Soft rot occurs wherever sweet potatoes are found, but collaborators are hesitant about trying to estimate the depreciation in value of the tubers. No doubt the losses are very large, particularly in storage and in markets. The rot is most often associated with some other form of injury. Judging from reports it is much easier to grow sweet potatoes than it is to keep them healthy after they are grown. The following states give actual percentages of injury for 1922: New Jersey, 8.5%; Texas 10%; Arkansas, 8%; Illinois, 1%; and Iowa, 20%. Other states reporting the presence of the disease are Delaware, Virginia, South Carolina, Florida, and Kansas.

New Jersey: Serious in some houses where curing was poorly done. Rats and mice were important in many houses causing much injury. The injured potatoes finally rotted due to infection by Rhizopus spp. (Poole)

Delaware: This year has been characterized with the greatest loss in sweet potato storage that has occurred to our knowledge in the last decade, and possibly in the history of this crop in Delaware.

The rots occurring are the result of the soft rot organism, Rhizopus sp. and the black rot, Sphaeronema fimbriatum. The soft rot is most prevalent and will probably account for 30% loss in the storage of sweet potatoes this year. The black rot will account

for a 10% loss of sweet potatoes in storage. One of our growers in the largest producing center states that soft rot will run about 30% and black rot 15%. Others report soft rot ranging from 20 to 30% and black rot 5 to 15%. In one instance 1500 baskets of stored sweet potatoes packed 210 hampers, when under normal conditions about 750 hampers should have been packed. This extreme loss is associated with various causes. The following explanations have been offered by growers.

1. Owing to the large crop the storage houses were over loaded, which prevented normal control of the moisture and temperature conditions.

2. There is a prevalent opinion that sweet potatoes were harvested and stored before they were mature. Many consider also that they contained excess moisture.

3. The failure to secure coal in many sections was an important factor, as it was impossible to maintain proper temperature conditions with the use of wood fires.

4. The majority of growers associate the excessive use of potash in their fertilizer applications. It is of further interest along this line that the fertilizer men observe in the orders being placed for sweet potato fertilizers that the amount of potash requested is much smaller than has been used in the past few years. (Adams)

Maryland: Heavy losses in storage houses of eastern Maryland due to overcrowding of the houses. (Jehle, March 1923)

Virginia: Losses in home storage in James City and Norfolk Counties ranged from 15-30%. (Fromme)

South Carolina: Tisdale reported loss in a few houses, ranging up to 3%; higher in some banks. Sometimes associated with black rot. (Ludwig)

Kansas: Present in most fields on potatoes that were injured by gophers. (Stokdyk)

Table 30. Prevalence of Rhizopus rot in car load lots of inspected sweet potatoes.

Origin of shipment	No. carloads inspected	Approx. av. % rot	Origin of shipment	No. carloads inspected	Approx. Av. % rot
New Jersey	8	5.6+	Georgia	3	14
Delaware	4	42.5	Tennessee	2	13.5
Maryland	3	12 +	North Carolina	1	6
Virginia	4	5.8+	Alabama	2	1+

A number of other fungi besides Rhizopus cause storage rots of sweet potatoes. In some of the reports the percentage of rot for all these organisms is included in one estimate.

Table 31. Estimated percentages of rot of sweet potatoes caused by all organisms.

State	% loss	State	% loss	State	% loss
Virginia	20	Illinois	1	Tennessee	3
South Carolina	2	Iowa	20	Mississippi	20
Georgia	10	Kansas	2	Louisiana	15
Indiana	4	Kentucky	50	Arkansas	12

According to Neal, storage rots are still very important in Mississippi, but the losses are becoming less where good storage house management is followed.

According to Lauritzen and Harter (1) there is a relation of humidity to the infection of sweet potatoes by Rhizopus.

> "Only a small percentage of potatoes halved with a knife became infected with Rhizopus when subject to relative humidities of 94 to 98% at temperatures 22.5 to 24°C.
>
> "The percentage of infection increases as the humidity is lowered until at a relative humidity of 72 to 84% it is nearly 100.
>
> "At relative humidities of 59 to 63% there is decrease in the percentage of infection and at 49 to 52% it is about 20.
>
> "At a temperature of 12°C the relation of humidity to infection is the same as at 22.5 to 25°C except that the range is narrower.
>
> "If potatoes subjected to humidities of 94% at 22.5 to 25°C are exposed to lower humidities, scarcely any infection occurs, but if potatoes subjected to humidities of 49 to 63 are placed at the same humidities nearly all become infected.
>
> "Apparently changes take place at the higher humidities which make the potatoes more resistant to the attack of Rhizopus. This resistance seems to be located in the outer cells of the cut surface, because if a thin slice is cut off from the potatoes parallel to the cut surface, these potatoes become infected."

References

(1) Lauritzen, J. I. and L. L. Harter. The relation of humidity to the infection of sweet potatoes by Rhizopus. Phytopath. 13: 56. 1923.

(Not cited)

Harter, L. L. and J. L. Weimer. Susceptibility of the different varieties of sweet potatoes to decay by Rhizopus nigricans and Rhizopus tritici. Jour. Agr. Res. 22: 511-515. November 26, 1921. (April 1922)

Foot rot caused by Plenodomus destruens Harter

Foot rot is limited in its distribution, and no more than a trace of loss is accredited to it. The following states record it: New Jersey (slight loss in Vineland section and in Toms River vicinity), Maryland (trace, southeastern part of state), South Carolina (trace), and Kansas (here and there a trace). It was not observed in Mississippi, Iowa, Louisiana, and Arkansas. The date of

earliest appearance is given as July at Vineland, New Jersey.

Pox or soil rot caused by Cystospora batata Elliott

Pox or soil rot has been known to cause much damage in individual fields but the losses in none of the states are high. The disease was found in the following nine states: New Jersey (.6% loss), Delaware (1.5%), Maryland (.5%), Mississippi (trace), Texas (1%), Kansas (2%), Virginia (trace), Louisiana (trace) and Arkansas (trace). It was reported as not present in Kentucky. Dates of first appearance: New Jersey, May in Gloucester County; Delaware, August 9 at Houston; and Kansas, September 12 at Riley.

Control measures

According to Poole in New Jersey "Progress has been made (in the control of pox) in treating soil with inoculated sulfur. Broadcasting 300 to 400 pounds just previous to making up ridges has given best results. From 4 to 5% nitrogen is advised for infected soils, where 2% is ordinarily used." Stokdyk in Kansas says pox is "on the increase in old fields where no control measures are practiced."

Scurf caused by Monilochaetes infuscans Hals.

Scurf is a widely distributed disease of sweet potatoes. Fortunately it has not reduced the crop or the salability of it to any great extent. Eleven states report its presence: Delaware (common), West Virginia (one case seen), New Jersey (1%), Maryland (.5%), South Carolina (trace), Florida (present), Mississippi (2%), Louisiana (slight), Arkansas (trace), Kansas (present), and Arizona (1%).

There is a slight difference in the susceptibility of varieties, but none of them are nearly enough resistant to be advocated as the varieties to use.

New Jersey: Serious and widely distributed in the state. It has been observed on all varieties grown in this state. Very serious on Nancy Hall. (Poole)

Delaware: The most commonly distributed disease affecting the roots. The disease was very severe where heavy applications of manure are used. (Adams)

Mississippi: Appears worse on the white skinned varieties. (Neal)

Control measures

Seed treatment and the application of inoculated sulfur are recommended.

New Jersey: Splendid control has been obtained on some soils by applying 300 lbs. inoculated sulfur. (Poole)

Delaware: Inoculated sulphur in experiments conducted this season have given practical control when used at the rate of 200-400 lbs. per acre. (Adams)

Arkansas: All varieties; seed treatment gives control. (Elliott)

Kansas: Treated seed free from the disease. (Stokdyk)

Miscellaneous tuber rots and injuries

Surface rot caused by Fusarium oxysporum Schlecht. has been reported from New Jersey by R. F. Poole who adds that "It is serious in some storage houses. All varieties grown in the state are attacked. Infection probably takes place in storage."

> "According to L. L. Harter and J. L. Weimer (Bur. Markets & Crop Est. Fruit & Veg. Div. Letter 3: after p. 73. March 9, 1922) who have made a thorough study of this rot, it occurs wherever the crop is grown. The loss varies in different years. In some houses where conditions are favorable for the disease the loss might run as high as 25%. Varieties vary in susceptibility; both Big Stem Jersey and Little Stem Jersey are readily attacked by the disease.
>
> "Infection takes place at digging time or a little before it, or early in the storage period, although the disease is not conspicuous until two weeks to six months after the potatoes have been in storage. The disease is caused by the organism Fusarium oxysporum.
>
> "When possible the potatoes should be harvested during dry weather and allowed to dry in the sun for a few hours before going into the storage house. Furthermore, the storage house should be warm and dry when the potatoes are put in, so that curing will begin promptly. This is especially desirable if the potatoes are dug from a wet soil during cloudy weather."

Charcoal rot caused by Sclerotium bataticola Taub. was reported from New Jersey, Texas and Louisiana. Poole (New Jersey) writes that "The disease causes no serious damage in this state. It has been found in storage houses in various counties. It is sometimes seen in the field on potatoes left on the ground after the crop has been harvested." In Texas it caused 1% loss, according to Taubenhaus.

Rot caused by Trichoderma koningi Oud. did some injury in storage in New Jersey.

Java black rot caused by Diplodia tubericola (E. & E.) Taub. was found in South Carolina (northeastern part of state, unimportant), Louisiana (very common, loss 2-4%), Texas (trace), and Florida.

Dry rot caused by Diaporthe batatatis Harter and Field was reported by L. E. Tisdale, crop pest commission inspector, as being present in one storage house last spring. (Ludwig - South Carolina)

Soft rot caused by Botrytis vulgaris Fr. attacked plants in hot beds and potatoes in storage, according to R. F. Poole (New Jersey). The disease was observed on all varieties grown in the state.

Tuber injuries (non-parasitic). Pithiness of stored roots was reported by Ludwig from South Carolina. Taubenhaus describes a hollowheart:

> "During 1917 and 1918, the writer received a large number of specimens of sweet potatoes which when broken open showed a hollow area in the interior of the sweet

> potato root. Cultures of the tissue yielded no organism. It seems that this condition was brought about by the extreme dry weather during the summers of 1917 and 1918, and this was further aggravated by the regular period of curing or sweating which these potatoes underwent in storage."

Dana of Washington found blackheart in market sweet potatoes.

Other diseases

White rust caused by Albugo ipomoeae-panduranae (Schw.) Swingle was observed in Delaware, South Carolina, Louisiana, Florida and Kansas. The loss was almost negligible except in Delaware where, according to Adams, it was more prevalent than usual, the mature spots on older leaves falling out and producing a shot-hole appearance. The dates of earliest appearance were in Delaware, July at Seaford; Illinois, July 31 at Cave-in-Rock; Louisiana in August; and at Clemson College, South Carolina, August 25.

Leaf spot caused by Phyllosticta batata Cke. was found in New Jersey, South Carolina, and Florida. There was no reduction in yield. Poole of New Jersey writes that leaf spot was observed on all Jersey grown varieties. In South Carolina it was first seen at Clemson College August 25 and during the same month in Gloucester County, New Jersey.

Leaf spot caused by Septoria batatícola Taub. was generally prevalent in New Jersey and Delaware although no injury to the crop was reported. R. F. Poole of New Jersey submitted the following information: "Slight variation noted in varietal susceptibility. The Jersey varieties are susceptible. The Dahomey, White Yam, Red Brazil and Triumph were somewhat more resistant."

Mosaic was found in Arkansas on the Nancy Hall variety and in Tennessee. Apparently no loss was sustained. (See Weber, Geo. F. Mosaic disease of sweet potato. (Abstract) Phytopath. 13: 42-43. Jan. 1923.

Foot rot caused by Macrosporium solani E. & M. reported as follows by Taubenhaus in Texas:

> "This disease was found in cold frames of tomato plants and in sweet potato beds in east Texas. It is similar to the one described by Rosenbaum and Pritchard on the tomato. From isolation and infection studies of the Texas material, it was found that Macrosporium solani was the only organism present in both the sweet potato and tomato material. Little difficulty was experienced in infecting healthy plants of both hosts with this fungus."

Texas root rot caused by Ozonium omnivorum Shear again was very serious in Texas, where Taubenhaus estimates that 6% loss was caused. J. G. Brown (Arizona) says, "Found in Salt River and Santa Cruz Valleys. From the former, George reports a reduction in yield amounting to 50%."

Sclerotium wilt caused by Sclerotium rolfsii Sacc. was reported from Louisiana (common in seed beds, loss slight, earliest appearance April 21) and South Carolina (seriousness increased by fact that in most instances disease occurred in plant beds).

Root knot caused by Heterodera radicicola (Greef) Müll. resulted in 3% loss in Arkansas (Elliott) - "There was a dwarfing of plants in the field and distortion of the roots. One peculiarity noted in a badly infected field was

that all the badly injured plants blossomed profusely."

A slime mold, Fuligo violaceae, was reported by Poole from New Jersey. It was seen in April and May on all local varieties and caused a stunting of the plants.

Chlorosis was mentioned by Taubenhaus of Texas. He suggests that an over supply of lime may be the cause.

General references on sweet potato diseases, etc.

Becker, Geo. G. Three years sweet potato certification work in Arkansas. (Abstract) Phytopath. 12: 252. May 1922.

Burger, O. F. and A. C. Brown. Some sweet potato diseases. Quart. Bul. State Plant Bd. Florida 6: 71-76. Apr. 1922.

Gardner, W. A. Notes on the physiology of the sweet potato. (Abstract) Phytopath. 12: 251. May 1922.

Harter, L. L. Field and storage diseases of the sweet potato and their control. Sweet Potato Bul. 27: 10-12. May 1922.

_____ Field and storage diseases of the sweet potato and their control. (Abstract) Phytopath. 12: 251. May 1922.

Manns, T. F. Diseases of the sweet potato. Trans. Penin. Hort. Soc. 35 (1921): 132-136. 1922.

Poole, R. F. Recent investigations on the control of three important field diseases of sweet potatoes. New Jersey Agr. Exp. Sta. Bul. 365: 5-39. 1922.

The results are given of studies on the control of yellows or stem rot of sweet potatoes due to Fusarium batatatis and F. hyperoxysporum, ground rot or "pox" (Cystospora batata), and scurf or soil stain (Monilochaetes infuscans).

_____ Sweet potato diseases in New Jersey. New Jersey Agr. Exp. Sta. Circ. 141: 3-31. Sept. 1922.

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BEAN

Bacterial blight caused by Bacterium phaseoli EFS

Bacterial blight continues to be one of the most destructive diseases of the bean. It is prevalent in nearly every state where beans are grown, and attacks almost all of the commercial varieties.

Vermont: I have just returned from a two weeks' trip inspecting bean fields in New York and Vermont. Bacterial blight is generally prevalent but as yet doing little harm to the main field crops. With favorable weather for its spread serious losses, especially in

Red Kidney sections, may again be expected this year. Many fields of early garden and canning varieties grown for seed have already been reduced in yield of marketable product from 10-50% because of blight. (R. D. Rands, August 17)

Bean anthracnose and bean blight are much above normal, due undoubtedly to late June and early July infections. (Lutman)

New York: (Genesee County) - Bacterial blight is showing up very commonly now. (L. C. Tyler, N. Y. St. Coll. Agr. Dept. Pl. Path. & Ent. Weekly News Letter, August 7, 1922.)

North Dakota: This disease rarely found in state, except in certain years, when a few plots are often severely infected. (Wanda Weniger)

Arizona: Disease most destructive for years, due to poor seed and weather conditions favoring disease. George reports 10% loss in Navajo and Apache Counties. (Brown)

(See also Plant Disease Bulletin 6: 61, 125, 126, 136. 1922)

Table 32. General prevalence of, and losses from, bacterial blight of beans in 1922, according to reports of collaborators.

State	Prevalence compared with Last Year	Prevalence compared with Average Year	Importance or Estimated % loss	State	Prevalence compared with Last Year	Prevalence compared with Average Year	Importance or Estimated % loss
New Hampshire			Present	Louisiana	Same		3
Vermont			10	Texas			Trace
Massachusetts		Same	1	Oklahoma			On late crop
Connecticut			3	Ohio	Less	Less	2
New York			3-5	Indiana	Less	Less	2
Pennsylvania			4	Illinois	Same	Same	Trace
Delaware	More	More	1	Michigan			General
Maryland	More	More	1.5	Wisconsin	Same	Same	1
Virginia			Trace	Minnesota	Same	Same	2
West Virginia	Less	Same	Trace	Iowa	Same	Same	2.5
Kentucky			General	North Dakota			0
Tennessee			2	Colorado			Present
South Carolina	Same		2	Arizona			1
Georgia	Same		1	Idaho			0
Florida			Considerable	Washington			0
Mississippi	Same	Same	3	Oregon			Present

The weather conditions evidently play a large part in determining the seriousness of the disease. In Massachusetts where there was a loss of 10% the disease was given its impetus by a very wet June. In Maryland where the summer was wet, blight caused greater loss than for the average year. In Indiana and Michigan later drouths checked the progress of the organism, so that the reduction in crop was less than usual.

Table 33. Earliest appearance of bacterial blight in 1922.

Date	Place	Date	Place
April 25	Hammon, Louisiana	July 1	Madison, Wisconsin
May	Mississippi	July 2	Ramsey County, Minnesota
June 17	Stratham, New Hampshire	July 20	New Haven, Connecticut
June 19	New Castle, Delaware	July	Wayne County, Ohio
June 22	Jefferson County, Illinois	August 15	Massachusetts

Beans lend themselves readily to cross breeding, and much work is being done with the object of developing varieties resistant to the different diseases. Unfortunately, no great progress has been made thus far in the procuring of blight-resistant strains. Inasmuch as this is one of the serious troubles of beans, and the planting of immune varieties the only practical method of control, it is hoped that such a possibility will soon be realized.

References

Gloyer, W. O. Bacterial blight of beans under field conditions. (Abstract) Absts. Bact. 6: 40. 1922.

Anthracnose caused by Colletotrichum lindemuthianum (Sacc. & Magn.) Br. & Cav.

Anthracnose is still one of the important bean diseases, even though considerable progress has been made toward its elimination by means of resistant varieties. The average losses according to all the reports were about 3% for 1922. This is not accurate since each state reporting does not have the same acreage of beans, thus the loss for the United States was probably even larger than that indicated.

Vermont: I have just returned from a two weeks' trip inspecting bean fields in New York and Vermont.....Here also anthracnose was occasionally observed, but rare in dry shell varieties. (R. D. Rands, Aug. 17)

South Carolina: Reported by county agents and probably correctly so from Charleston and Georgetown Counties, but we have no positively authentic records. (Ludwig)

Mississippi: The disease is widespread this season, particularly in the southern trucking sections of the state. Reported from Pearl River, Stone, Harrison, Jackson, Lamar, George, Clarke, Copiah, Marion, and Hinds counties. It has resulted in serious loss in several instances, many five and ten acre fields being damaged as much as 75%. W. L. Blain, Pathological Inspector, State Plant Board, reports a complete loss of five acres in Harrison County because of the disease. No doubt scattered everywhere by infected seed. Why not pass a federal seed inspection law? This would prohibit seed dealers from selling infected seed such as bean anthracnose, which is easily discernible. It's a crime for a grower to pay $12.00 a bushel for bean seed from a dealer, put in his labor, fertilizer,

and then have a total loss from anthracnose. This is what has happened all over the state this season - the growers have purchased anthracnose infected seed the bulk of which comes from Michigan and New York state. We will have to put on a home grown seed program down here unless the northern growers can supply anthracnose free seed. It has certainly wrought havoc this season. (D. C. Neal)

Louisiana: Infection scattering. A few fields were a total loss but in most fields there was but little anthracnose. (Edgerton)

(See also Plant Disease Bulletin 6: 61, 93, 126, 136. 1922)

Table 34. Prevalence and losses from bean anthracnose in 1922, as estimated by collaborators.

State	Prevalence compared with Last Year	Prevalence compared with Average Year	Estimated percent loss	State	Prevalence compared with Last Year	Prevalence compared with Average Year	Estimated percent loss
New Hampshire	Worse	Worse	25	New Jersey			Present
Vermont			5	Pennsylvania			6
Massachusetts		Same	3	Delaware			.5
Connecticut			1	Maryland	Same	Same	
New York	More	Less	1-3	West Virginia	Same	Same	4
Tennessee			2	Wisconsin	Less	Less	1
South Carolina			Trace	Minnesota	More	Same	Trace
Georgia	Less		1	Iowa	Same	Same	.5
Florida			Present	North Dakota	Less	Less	Trace
Mississippi	More	More	5	Missouri			3
Louisiana	Same	Less	1	Colorado	Same		
Arkansas			Present	Oregon			Present
Ohio	Same	Less	4	Idaho			0
Illinois	Less	Less	Trace	Washington			0
Michigan			Present				

The nature of the discharge of the spores of Colletotrichum necessitates the presence of moisture for their dissemination, consequently the spread and severity of the organism are dependent entirely upon weather conditions.

Vermont: The outstanding weather conditions for Vermont were: a very wet June, the wettest on record for this region, with a normal temperature; a rather dry and warm July, but with enough rain to prevent the soil from ever becoming really dried out; and a normal August and September both as to rainfall and temperature. The very cool nights, all summer, have been another peculiar feature of the summer of 1922.

.....The bean anthracnose and bean blight are much above normal due undoubtedly to late June and early July infections. (Lutman)

Control measures

The only practical method of control is in the use of resistant varieties. A number of such varieties are now being put on the market, so that the prediction seems justified that in the not too distant future all snap and dry beans will be of this sort.

New York: Nearly all dry beans now grown in the state are resistant or at least partially resistant to anthracnose so that the loss has been reduced very much. (Chupp)

Mississippi: The green snaps and green bush varieties are, as a rule, resistant, whereas the bush wax sorts are very susceptible. (Neal)

Wisconsin: In test fields of Everett B. Clark Seed Company, Marshall, on September 1 noted French Horticultural highly resistant and Dwarf Horticultural heavily infected. (Vaughan)

Reference

Hopkins, E. F. The effect of lactic acid on spore production by Colletotrichum lindemuthianum Phytopath. 12: 390-393. Aug. 1922.

Rust caused by Uromyces appendiculatus (Pers.) Lév.

The amount of bean rust present each year apparently fluctuates less than that of most other diseases. It was reported as more than last year in Massachusetts, Delaware, Ohio, Indiana and Illinois. Even in these states no serious loss was recorded. Other states where it was found are Vermont, Connecticut, New York, Maryland, West Virginia, Kentucky, South Carolina, Georgia, Mississippi, Texas, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, Missouri and Colorado. The disease appears late in the season so that the dry beans being almost at maturity suffer only minor losses. The first recorded appearance was at Westville, Connecticut June 30. During July it appeared in Illinois and Delaware, during August in Ohio and New York, and during September in Vermont, Wisconsin, Minnesota and Missouri. The rust is more common on the pole beans than on the dwarf varieties. In six states the Kentucky Wonders were mentioned as being extremely susceptible. No control measures were reported.

Vermont: Noted locally, very bad on pole limas, but also on dwarf pole horticultural and black wax, but not so abundantly. Not seen on field beans. (Lutman)

Connecticut: Two reports, first June 30, Westville. This report was of the I stage, the first time we have found it in this state. Kentucky Wonder in both reports. (Clinton)

Kentucky: J. L. Van Arsdell of Sharpsburg reported on August 16 that rust was so bad on pole, bunch and cornfield beans that he expected the crop to be destroyed. (Valleau)

Florida: The disease was quite general in all shades where beans were planted after tobacco. Kentucky Wonder and Refugee are the varieties generally planted. The Refugee appears to be very resistant. The growers do nothing to control this disease or any

other. They plant the land under the shades with some crop so they will get some returns from their labor involved in clean cultivation. (W. B. Tisdale, Aug. 8)

Mosaic

Mosaic, though not reported as often as anthracnose or blight, was present in almost all bean growing areas. In the past it has caused great reductions in yield, and in the pea bean sections the growers have given up bean growing, or turned to the use of other types. With the advent of the Robust pea bean, the entire situation was changed. Farmers are now increasing their pea bean acreage each year. Furthermore, the plant pathologists and plant breeders are busy crossing both snap and dry bean strains with the Robust as one of the parent plants in an attempt to develop mosaic-resistant varieties of the different commercial types.

New York: Important in fields of susceptible varieties. Nearly all dry beans now grown in the state are resistant varieties. Since beans resistant to the more serious diseases are grown, the acreage has been increased enormously. (Chupp)

Indiana: On August 8 an examination was made of a plot of 52 seedsmen's varieties grown by H. D. Brown and 35 showed mosaic, probably of seed origin. In general only low percentages were mosaic but in Refugee from several sources, a high percentage occurred, as also in Golden Wax, Dwarf Horticultural, Flageolet Violet Wax, White Marrow, and Hodson Wax. None occurred among several plots of bush Limas. (Gardner)

Of the varieties noted free from mosaic last year, Wardell's Kidney Wax (120 plants) and Black Valentine (42 plants) were free this year.

Improved Goodard and Webber Wax were not tested this year.

The varieties noted to be free last year which showed mosaic this year were:

	No. of plants	No. mosaic	%
Red Kidney.....	333	6	2
Saddleback Wax.....	161	13	8
Dwarf Horticultural..	120	58	49
Robust Pea.....	230	3	1.3

Kentucky Wonder very susceptible, and seed usually infected.

(See also Plant Disease Bulletin 6: 93, 126. 1922)

Table 35. Prevalence of, and estimated losses from, mosaic in the United States in 1922.

State	Estimated % loss	State	Estimated % loss	State	Estimated % loss
Vermont	Present	Maryland	Trace	Louisiana	Trace
Massachusetts	Trace	Mississippi	1	Iowa	2
Connecticut	.5	Tennessee	1	Idaho	5
New York	1-3	Indiana	3	Washington	2
Pennsylvania	2-3	Wisconsin	Trace	Oregon	Present
Delaware	Present	Minnesota	2	Utah	1

References

Matsumoto, Takashi. Some experiments with adzuki-bean mosaic. Phytopath. 12: 295-297. June 1922.

Nelson, Ray. Transference of the bean mosaic virus by Macrosiphum solanifolii. Science n.s. 56: 342-344. Sept. 22, 1922.

> "The spread of bean mosaic was observed during 1921 under conditions which strongly suggested transfer by insects. The sudden appearance of the disease in the water cultures of beans growing in the greenhouse, and infested with aphids, indicated even more definitely the mode of dissemination. Definite proof of the transfer of the virus by Macrosiphum solanifolii was obtained under controlled conditions, both in the greenhouse and in the field."

(See also references under potato mosaic)

Root rot caused by Fusarium spp.

It is difficult to summarize the data on root rot, because the collaborators are not always sure of the cause. The organisms by all means should be identified, if that were possible, so that when dry root rot is mentioned it can be said that it is caused by Fusarium martii phaseoli or some other Fusarium. No doubt Dr. W. H. Burkholder, Cornell University, Ithaca, New York, who described the organism, would be willing to identify specimens of dry rot if they were sent to him. The following states have reported a Fusarium root rot of beans: Vermont (very abundant, 1% loss), Massachusetts (1%, Fusarium and Rhizoctonia general), Connecticut (.5%), New York (2-5% loss), Pennsylvania (3%), Maryland (trace), Virginia (trace), West Virginia (trace), Kentucky, South Carolina (trace), Florida, Mississippi (1%), Louisiana (trace), Illinois (trace), Wisconsin (0), Minnesota (trace), and Quebec, Canada. In the South the Fusarium is more of a damping-off organism. (See also Plant Disease Bulletin 6: 93, 127, 136. 1922). Burkholder (New York) writes as follows:

> "I have received specimens of root rot of beans from only Vermont and Michigan that I felt sure were caused by Fusarium martii phaseoli. Last summer, however, some specimens were sent in from Indiana and Washington, D. C. which I thought were the same disease, but they were in a rather bad condition and I was not positive."

Control measures

In New York and possibly in other states attempts are being made to breed root rot resistance into some of the more commonly used varieties.

Other diseases

Powdery mildew caused by Erysiphe polygoni DC. was reported from West Virginia, South Carolina, Florida and Texas. In no case was there any appreciable damage. John L. Sheldon (West Virginia) writes: "This is the first time I recall finding a powdery mildew on beans. Three species of clover - all

mildewed - were growing near the late-planted beans and I expect this rare infection came from the clover."

Leaf spot caused by Cercospora cruenta Sacc. was found in Texas where it did only a trace of injury, and from Gadsden, Florida, from which place W. B. Tisdale writes: "The disease appeared on lower leaves during period of wet weather; variety, Kentucky Wonder. The affected leaves shed and the disease did not appear on the upper leaves."

Angular leaf spot caused by Isariopsis griseola Sacc. was observed August 31 at Walhalla, South Carolina, and was common and destructive to a few late bunch beans in a garden in Morgantown, West Virginia.

Vine and pod rot caused by Sclerotinia libertiana Fckl. was reported from New York, where it caused .5-1% injury. It was prevalent in low fields where the vines were extremely large. According to observations made by F. R. Perry the disease was worse in fields where Sclerotinia appeared the year before, and no rotation of crops was practiced. It was also one of the serious transportation rots of snap beans.

Rhizoctonia stem rot caused by Corticium vagum B. & C. severe on late plantings of snap beans in Texas. Taubenhaus reports 50% loss of these plantings. In Louisiana it was also more severe on the fall crop than that planted in the spring. The first report was November 9. The same trouble was reported from Florida, Mississippi, and Idaho.

Southern blight or wilt caused by Sclerotium rolfsii Sacc. was observed in Texas (very prevalent), Louisiana (1-2% loss, first observed May 1), and South Carolina (trace).

The Texas root rot caused by Ozonium omnivorum Shear was reported by Taubenhaus of Texas as causing 8% loss.

Root knot caused by Heterodera radicicola (Greef) Müll. was reported in South Carolina and Texas. In South Carolina it was also found on the Mung beans, two rows of which were practically destroyed. In Texas, Taubenhaus estimated the root knot loss at 2%.

Hopperburn caused by Empoasca mali was observed July 10 at Madison, Wisconsin. It was serious on beans which grew adjacent to potatoes.

A non-parasitic pod spot of bean was reported by Dana of Washington.

Chlorosis caused by too much lime in the soil resulted in 1% loss according to Taubenhaus of Texas.

DISEASES OF LIMA BEANS

Downy mildew caused by Phytophthora phaseoli Thax.

Downy mildew does an immense amount of injury to the lima bean crop in the eastern part of the United States, and was especially abundant this year. It was present in Connecticut, New York, New Jersey, Pennsylvania, Delaware, Virginia, West Virginia and Ohio. The epidemic was most pronounced on Long Island and in New Jersey, gradually diminishing westward until in Ohio it caused only a slight loss. On Long Island it was first found August 5, Connecticut August 9, Delaware in September, and in Ohio October 3.

Connecticut: More than usual; ten reports, quite serious in some fields. Earliest report of the disease August 9 at Westville. Sixty-five percent of crop injured in one field, and 20% loss is estimated for the state. (Clinton)

New York: In Mattituck section by middle of August the disease became very prevalent and by September 1 the pods on hundreds of acres were covered with white mould. Earliest recorded appearance was August 5. Destroyed all beans on late planting, and reduced the crop on the early planting. (Clayton - Long Island)

New Jersey: In Monmouth County 10% of a planting of 2,000 acres were not picked due to attack by this disease. Av. yield 90 cases of beans per acre,- this year 67 cases. (Dept. of Plant Pathology)

Virginia: Severe loss of pods at Edinburg, Shenandoah County. (Fromme)

West Virginia: Local. Very severe case observed in Marion County. There was a trace of loss for the entire state, but as high as 95% was found in one field. (Department of Plant Pathology)

Other diseases

Bacterial blight caused by Bacterium phaseoli EFS was noted on bush limas in Marion County, Indiana, October 4. (Gardner)

A bacterial leaf spot was reported from Connecticut and Delaware. In the former state it was recorded for the first time. G. P. Clinton suggests that it is probably the disease reported by Tisdale and Williamson. It was found June 20 at East Hampton. In Delaware Bacillus laythri Manns & Taub. is suggested as the cause of the leaf spot. In neither case was it of economic importance. The new bacterial organism which has been described on common beans by F. Hedges (A bacterial wilt of the bean caused by Bacterium flaccumfaciens. nov. sp. Science n.s. 55: 433-434. 1922), was successfully inoculated into Lima bean plants also.

Yeast spot caused by Nematospora phaseoli Wingard, was general in the middle and tide water sections of Virginia, producing 5% reduction in the crop. The maximum found in any one field was 75%. The disease seems to flourish better in the warmer sections. It spots and shrivels the seed. Reference: Wingard, S. A. Yeast spot of lima beans. Phytopath. 12: 525-532. 1922.

Pod blight caused by Diaporthe phaseolorum (C. & E.) Sacc. (Phoma subcircinata E. & E.) was found in July at Houston, Delaware, and although more common than usual, was not of economic importance.

Rust caused by Uromyces appendiculatus (Pers.) Lév. was observed in Vermont (on pole Limas, locally very bad) and in Pennsylvania.

Stem rot caused by Sclerotinia sp. was reported from Marion County, Indiana May 24. It was not important. A Fusarium on Lima beans was collected once in Hamilton County, Ohio, September 18.

Anthracnose caused by Colletotrichum lindemuthianum (Sacc. & Magn.) Br. & Cav., was reported only from West Virginia.

DISEASES OF ONION

Smut caused by Urocystis cepulae Frost

"An investigation by L. R. Jones and J. C. Walker of the relation of soil temperature to the development of onion smut showed rapid development of

the disease at 60° F and when the temperature rose to 84°F it was completely checked." ((1) Abst. from Exp. Sta. Rec. 47. Oct. 1922) The temperature accounts for the presence of the smut only in the northern tier of states. Certainly the inoculum must have been carried farther south than northern Indiana and Ohio. The disease has gradually increased in the older onion sections until some soils are no longer profitable for onion growing. In Orange County, New York, which is a typical onion section, M. C. Hammond made a series of counts in different localities and found from 18 to 36% of smut, depending upon the length of time the land had been farmed. Smut was reported from Massachusetts (5%), New York (20%), Ohio, Indiana, Wisconsin (a maximum in some fields of 60%), and in Oregon. In Iowa no smut was observed. In Wisconsin the disease was first observed May 15 at Racine, and in Orange County, New York in June. (Also see Pl. Dis. Bul. 6: 137. 1922)

Control measures

The formaldehyde drip is generally used, and is commercially very profitable.

> "All investigators have employed essentially the same type of apparatus which has no provision for eliminating variation in rate of application due to reduction of pressure as the column of liquid lowers in the open tank and to speed of operator. To obviate these difficulties a new type of apparatus has been developed at the Massachusetts Agricultural Experiment Station. The chief features of the improved equipment are: (1) a tank made air-tight at the top by a screw-cap, air to replace the liquid being admitted through a stand-pipe attached near the bottom which eliminates variation in rate of flow due to diminishing head; (2) changeable discs with graded openings which fit into a union in the delivery pipe regulate the size of the outflow stream to correspond with the rate at which the operator walks. A table based on formulae of application and the time it was found that different operators required to push the drill a certain unit of distance indicates to the operator which of the numbered discs to use." (Osmun, A. V. and P. J. Anderson. (Abstract) Phytopath. 13: 58. Jan. 1923)

New York: Farmers who do not use formaldehyde sow ten pounds seed an acre. With formaldehyde they sow six to seven pounds. The difference is enough to pay for the formaldehyde used. (Chupp)

(Orange County) - Onions in general in good shape considering the conditions in that section and the character of the growers. On June 16 I made counts of smut and found the following on the different tests:

John Volock	Check plot	6% smut
	Formaldehyde treated	2% "
Bernard Dowd.....	Check plot	15% "
	Formaldehyde treated	3% "
	Field lime-sulfur treated	32% "
Frank Kurowski	Check plot	19% "
	Formaldehyde treated	2% "
John Meany	Check plot	40.4% "
	Formaldehyde treated	6% "

This test shows up to the best advantage of any that I have so far had.

Stanley Raubnski....	Check plot	31% smut
	Formaldehyde treated	5.6% "
	Lime sulfur	35% "

(M. C. Hammond, N. Y. St. Coll. Agr. Dept. Pl. Path. & Ent. Weekly News Letter, June 26)

Ohio: Only one report. Disease not believed to be serious this year in state. Formaldehyde drip attachment in general use in onion sections. (Thomas)

Indiana: Occurred in Lake County only. Gregory reports smut not destructive because it thinned the stand and enabled the healthy plants to better endure the drouth. Gregory found trouble from rain dilution of the formaldehyde in the soil. (Gardner)

Wisconsin: Well under control by formaldehyde drip treatment. Growers have arranged 60-gallon tank on horse-drawn drills. (Vaughan)

Oregon: Serious and destructive in northern Willamette Valley onion sections except where formaldehyde disinfection of the drill row at seeding time was practiced. Not all fields are affected as yet. (Barss)

Recent literature

(Cited)

1. Plant disease investigations. Wisconsin Agr. Exp. Sta. Bul. 339: 32-38, 39-48, 113. 1922.

(Not cited)

Anderson, P. J. Development and pathogenesis of the onion smut fungus. Massachusetts Agr. Exp. Sta. Tech. Bul. 4: 99-133. Nov. 1921.

Gregory, C. T. The relation of rain to the formaldehyde treatment of onion smut. Phytopath. 12: 155-156. March 1922.

Osmun, A. V. and P. J. Anderson. An improved formaldehyde tank for the onion drill. (Abstract) Phytopath. 13: 58. Jan. 1923.

Other diseases

Downy mildew caused by Peronospora schleideni Unger. is reported from surprisingly few states, and in none was it of any special importance, unless it be in New York where the estimated loss is 2 to 3%. Other states where it was present are Louisiana, Ohio, Wisconsin, Washington and Oregon. In New York it was first observed July 20 in Chenango County, and in Wisconsin, August 1 at Phillips.

Leaf mold caused by Macrosporium parasiticum Thüm. and M. porri E. has been included in the reports from Massachusetts, New York, Louisiana and Minnesota. In Massachusetts there is an increase of the disease over last year, the trouble being confined largely to the Connecticut Valley. In Louisiana 50 to 75% of the seed onions are attacked, with a resulting loss of 30 to 50%. In Minnesota there was only a trace of the disease. The trouble was first observed in Louisiana in April, and in Ramsey County, Minnesota, July 7.

Smudge or anthracnose caused by Colletotrichum circinans (Berk.) Vogl.

was observed on white onions in Delaware, Indiana and Wisconsin. Vaughan of the latter state says that "white onions little grown commercially. Red variety largely grown is highly resistant." Reference: Averna Sacca, Rosario. Colletotrichum circinans (Berk.) Vogl. Bol. Agr. Sao Paulo 23: 76-78. 1922.

Black mold caused by Aspergillus niger Van Tieghem was found once in New York (July 27, Erie County), caused .5% injury in Texas, and was reported in six carloads from Indiana by inspectors of the Bureau of Agricultural Economics.

Bacterial soft rot was reported as causing considerable loss in market gardens at Lynchburg, Virginia (Fromme). J. J. Gardner of Kenton, Ohio (Bur. Agr. Econ. Fruit & Veg. Div. Letter Oct. 12, 1922) writes: "I have seen considerable stock from different places around the marsh and it all runs heavy to decay, Neck Rot and Slimy Soft Rot. I expect that all of this stock from here will show considerable decay on the markets."

Neck rot caused by Botrytis allii Munn was present in New York, Ohio, Indiana, Wisconsin, Idaho and Washington. Vaughan of Wisconsin estimated that the loss was only a trace in his state. None of the other collaborators ventured an estimate. Inspectors of the Bureau of Agricultural Economics reported it in 18 cars of onions from six localities in Indiana. (Gardner)

Rot caused by Fusarium sp. was widely distributed, being found in New York, South Carolina, Indiana, Wisconsin, Idaho and Washington. In New York it was reported once from Erie County, July 27. In South Carolina it was of some importance in Anderson County where it was observed January 6. Vaughan of Wisconsin states that it was "complicated with maggot injury. Difficult to say which is most responsible." Heald (Washington) writes that "Fusarium rot has caused heavy loss of onions in the truck section of Walla Walla."

Pink root caused by Fusarium malli Taub. was reported from New York, Texas, Wisconsin, and Oregon. There was a trace of injury in New York and Wisconsin. In Texas the loss was 5% and for Oregon, Barss reports that in a number of fields in Washington County there was considerable evidence of root damage due to some apparent disease suspected to be pink root. (See Plant Disease Bulletin 6: 137-138. 1922) The disease was first noted in Wisconsin July 1 at Racine. References: Howitt, J. E. Two diseases new to Ontario. Scient. Agr. 3: 189. Jan. 1923. Whetzel, Herbert H. The pink-root of onions. Agr. Bul. Bermuda Dept. Agr. July 1922.

A slimy soft rot was unusually serious both in the field and storage in the Connecticut River Valley of Massachusetts. (Osmun)

DISEASES OF CRUCIFERS

CABBAGE

Club root caused by Plasmodiophora brassicae Wor.

The area where club root was of importance in 1922 was rather limited. The boundary line of this area was roughly the southern end of Pennsylvania, as far west as Minnesota, and to the Canadian border. It is not generally distributed over the states included in this area, but is more or less localized. When the organism is once introduced into a community, the extent of the infested soil gradually enlarges.

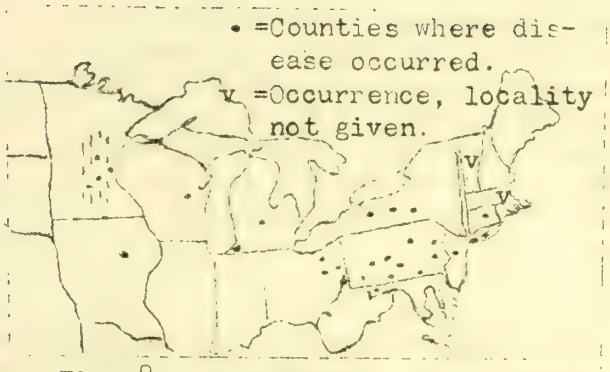

Fig. 8. Distribution of club-root by counties, as reported by collaborators in 1922.

New York: Common but not usually serious. One field with 90-100% infection due to use of refuse from kraut factory as fertilizer. (E. E. Clayton)

Michigan: Cabbage club root and yellows found by Nelson to be very serious about trucking section near Grand Rapids. Liming 3 T to acre reported successful with many in control of club root. (Coons, July 1922)

Wisconsin: Several fields near Racine have been abandoned. for cabbage. The outbreak at Appleton was in seed bed. Infected plants had been set in several fields before observed. (Vaughan)

North Dakota: One instance reported in 1920, but not observed since then, although it may be present. (Weniger)

Club root apparently was present in its usual degree, excepting in Massachusetts and Minnesota where more was reported. The percentages of loss given are Vermont (1-3%), New York (2%), Maryland (1%), and Michigan (trace).

Weather relations

"Studies by J. Monteith, Jr., of the soil temperature and moisture relations of cabbage clubroot showed a wide range of temperature in which the fungus could develop, but when the moisture content of the soil was reduced to one-half its water-holding capacity there was no development in most soils." (Plant disease investigations. Wisconsin Agr. Exp. Sta. Bul. 339: 32-38, 39-48, 113. 1922. Abst. from Exp. Sta. Rec. 47. Oct. 1922)

Table 36. Earliest recorded appearance of club root in 1922.

Date	Place	Date	Place
June 15	Appleton, Wisconsin	August 3	Storrs, Connecticut
July 17	Ramsey County, Minnesota	August 27	Stark County, Ohio
July	Cortland, New York	September 25	Vermont

Control measures

"Experiments were begun in 1915 in cooperation with the department of horticulture for the control of club-root of cabbage. The soil was treated with Bordeaux mixture, ammoniacal copper carbonate, formaldehyde, sulphur, and lump lime. The residual effects of Bordeaux

mixture and lime were apparent after 4 years, but the soil was again thoroughly infested after 6 years. The treatments were repeated in 1921 with copper-sulphate solution, Bordeaux mixture, lump lime, milk of lime, ground lime-stone, lime sulphur, and nicotin sulphate. One year's planting since the second treatment showed that Bordeaux mixture applied in amounts equal to the heaviest treatment of calcium oxid gave the best results. Lime sulphur was injurious." (Pennsylvania Agr. Exp. Sta. Bul. 170: 15-19, 19-20. 1922. Abst. from Exp. Sta. Rec. 47. Oct. 1922)

References

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Schaffnit, Ernst. Versuche über die empfänglichkeit verschiedener kohlsorten für den errengen der kohlhernie. Deut. Obstbau. 68: 211-212. 1922.

Sommer, Heinrich. Kohlhernie-bekämpfung mit uspulun im jahre 1921. Gartenw. 26: 70-71. 1922. (Also in Deut. Obstbau. 68: 43-44. 1922)

Vercier, H. J. A propos des maladies du chou: le gros pied. Rev. Hort. 94: 146-148. 1922.

Yellows caused by Fusarium conglutinans Woll.

Yellows, as has been shown by past research, is favored by higher temperatures and therefore is more common in the states where the temperature is relatively high in summer. New England and New York have not suffered much loss but in other states where yellows is abundant the loss is appalling.

Pennsylvania: Very general in counties reported (southern half of state); mostly garden patches. (Orton & Thurston)

Ohio: Yellows is becoming a serious limitation to early cabbage growing in the state. (Thomas)

Iowa: Serious around Muscatine and along Mississippi. (Melhus)

Missouri: Hot dry weather in June favorable to development of disease. (Rosa)
Occurrence general, 1 to 50% of crop injured. None in the common early varieties. (Maneval)

North Dakota: Disease has never been severe in state. Found in other years in isolated instances. Either the disease is not prevalent here as yet, or our varieties are resistant. (Weniger)

(See also Pl. Dis. Bul. 6: 39, 62, 125, 147. 1922)

Table 37. Prevalence and losses of cabbage due to yellows in 1922.

State	Prevalence compared with Last Year	Prevalence compared with Average Year	Estimated percentage losses or importance	State	Prevalence compared with Last Year	Prevalence compared with Average Year	Estimated percentage losses or importance
N. Y.			Present	Ind.	More	More	5
Pa.			Present	Ill.	More	More	5
Del.			.5	Mich.			Very serious
Md.	Same	Same	8	Wis.	More	More	
Va.	Same	Same	Most important	Ia.	More		25
Ky.	Less	Less	3.5	Mo.		Less	10
S. Car.			Trace	N. Dak.		Less	Present
Miss.			General	Kans.	More	More	35
Tex.			18	Colo.			Present
Ark.	Same	Same	15	Mont.			Present
Ohio			Limiting factor				

Table 38. Dates of earliest recorded appearance in 1922.

Date	Place	Date	Place
January 24	John's Island, South Carolina	June 3	Corliss, Wisconsin
April 13	Coshocton County, Ohio	June 13	Douglas County, Kansas
June 1	Somerset, Virginia	July 15	Denver, Colorado
June 1	Vincennes, Indiana	July 22	Saline County, Illinois

Susceptibility and control

Dr. L. R. Jones and his associates have done an exceptionally fine piece of work in the selecting of disease resistant cabbage. Not only has it had a direct effect upon cabbage growing, but it has stimulated the selecting and breeding of other vegetables for disease resistance. The obtaining of resistant varieties is the only practicable method of control of yellows. The difficulty is not so much in procuring strains desirable, as it is in keeping the strains pure when distributed among commercial firms. Vaughan suggests a government testing agency to overcome this drawback.

Delaware: New Brunswick and All Seasons prove resistant in the demonstration work. (Adams)

Virginia: Most important cabbage disease. A considerable acreage planted with resistant All Seasons which proved resistant. Supposed resistant Wisconsin Hollander fell down badly. (Fromme)

Indiana: Limiting factor, everywhere with crop. Gregory noted yellows in Lake, Marion and Vigo Counties. Use of resistant varieties is very general. Gregory is assisting Indianapolis market gardeners to develop a resistant early variety. He distributed resistant seed to growers in 32 counties. (Gardner)

Wisconsin: Eastern section, reported for first time as far north as Marinette. Period of high temperature in May stimulated development. Another case of failure of commercially produced resistant seed to stand up. We need a government testing agency to have seed proved before offered for sale. Checked about August 1 following rain and cooler weather. (Vaughan)

Kansas: All Seasons and Brunswick resistant if planted in sterile hotbed and transplanted. Susceptible when sown late in open field. Copenhagen susceptible. (Stokdyk)

References

Gregory, C. T. Cabbage yellows. Purdue Agr. Ext. Bul. 104: 1-8. 1922.

Jones, L. R. and J. C. Walker. Yellows - resistant cabbage varieties. Some necessary precautions for seedsmen to consider in the production and distribution of seeds of new special strains. Seed World 13: 20-21. Feb. 1923.

Jones, L. R., J. C. Walker and E. C. Tims. Work upon Fusarium - resistant cabbage in 1922. Phytopath. 13: 57. Jan. 1923.

"The work of the last two summers with disease resistant cabbage has been essentially a continuation of that of preceding years with increasing attention to securing Fusarium resistant strains of certain early varieties. In this the developments promise ultimate success although technical difficulties in holding the early varieties over for seed production have slowed up progress. In addition to established strains of the three later varieties (Hollander, All Seasons, and Brunswick), we have promising resistant strains of the earlier varieties (All Head and Glory)."

Manns, T. F. Cabbage wilt and stem rot in Delaware. Delaware Agr. Exp. Sta. Bul. 132: 3-24. June 1922.

Walker, J. C. Fusarium-resistant cabbage. (Rev. of: (1) Jones, L.R., J. C. Walker, and W. B. Tisdale. Fusarium resistant cabbage. Wis. Agr. Exp. Sta. Res. Bul. 48: 1-34. 1920. (See Bot. Absts. 10, Entry 99). (2) Jones, L. R. and J. C. Gilman. The control of cabbage yellows through disease resistance. Wisconsin Agr. Exp. Sta. Res. Bul. 38: 1-70. 1915.) Bot. Gaz. 73: 155-157. 1922.

Black rot caused by Bacterium campestre (Pammel) EFS

In the eastern part of the United States there was more black-rot than usual, while in the middle west the prevalence was the same or less. Undoubtedly, a big percentage of the disease is caused by infection from the bacteria on the seed. It is understood that some of the large cabbage seed producers will undertake to disinfect the seed before placing it in the hands of seed distributors. If this is done generally it will mean almost the entire elimination of black rot from among the diseases of cabbage, and will be a saving of thousands of dollars to farmers.

Kentucky: Infection could be traced in some cases to certain lots of seed. (Valleau)

Florida: Black rot was severe over the entire state the past season. (Burger)

Fig. 9. Distribution of black rot of cruciferous hosts, as indicated by reports to the Plant Disease Survey, 1903-1922.

Table 39. Prevalence of, and losses from black rot of cabbage in 1922.

State	Prevalence compared with Last Year	Prevalence compared with Average Year	Estimated percentage losses or importance	State	Prevalence compared with Last Year	Prevalence compared with Average Year	Estimated percentage losses or importance
Vt.	More	More	1	La.			2-10
Mass.	More		General	Tex.			3
N. Y.	More	More	5-10	Ohio			Present
Pa.		Same	Present	Ind.			Not serious
Del.	More	More	.5	Ill.	Same	Same	1
Md.			Trace	Wis.	Less	Less	2
Ky.	More	More	2.5	Minn.	Less	Less	Present
S. Car.			Trace	Ia.	Same	Same	Trace
Florida	Same	Same	Severe	N. Dak.			0
Miss.			Damage slight				

Mississippi: Reported from Copiah, Hinds, Stone, Pearl River and Lauderdale Counties. Damage slight in all localities reporting the disease. (Neal)

Louisiana: Most severe on the crop that runs into the warm weather in the spring. In some places evidently brought in on seed. (Edgerton)

Indiana: Gregory attributes infection to disease-carriage on seed imported from Long Island. Not treated. (Gardner)

Dates of earliest appearance are as follows: January 6, Arabi, Louisiana; May 10, Wiggins, Mississippi; June 12, Central City, Illinois; July 7, Ramsey County, Minnesota; July, Newark, Delaware; August 20, Madison, Wisconsin; and September 25, Vermont.

Control measures

New York: Where seed was treated with corrosive sublimate for twenty or thirty minutes, or in hot water 133°F. for ten minutes, the disease was much reduced or entirely eliminated. (Chupp)

Black-leg caused by Phoma lingam (Tode) Desm.

In New York, Pennsylvania and Arkansas there was a big increase in the amount of black-leg present. The earliest report of the disease was April in Nassau County, Long Island, New York. On June 27 it was found in Ramsey County, Minnesota, and on July 20, at New Castle, Delaware.

Table 40. Prevalence and importance of black-leg of cabbage in 1922.

State	Estimated percentage loss or importance	State	Estimated percentage loss or importance
Massachusetts	Unusually severe	Arkansas	20
New York	5	Ohio	General
Pennsylvania	Maximum 90%	Indiana	Present
Delaware	1	Wisconsin	Trace
Maryland	1.5	Minnesota	Not important
Virginia	Present	Iowa	" "
Louisiana	Slight		

New York: According to I. H. Vogel, black-leg was found in seed fields in Mattituck, Suffolk County, representing about 1% of the acreage under observation. Seemed fairly favorable although very little pod infection occurred. (E. E. Clayton)

Much rain, which increased the amount of disease. Several seed growers up-state inadvertently got black-leg in their seed stock and the organism was pretty well distributed. (Clayton and Chupp)

New Jersey: Abundant in Camden County, present in other parts of state. June and July wet. (Department of Plant Pathology)

Arkansas: Little or no treatment. Some large plantings were made that were a total loss. (Elliott)

Indiana: Gregory noted 100% loss in one field (Marion County) and 10% loss in a field in DeKalb County. Traced one case to seed bed infection. (Gardner)

Wisconsin: Much less around Racine. Large amounts of seed treated, or seed from inspected fields from clean stalks. Also less frequent rains during seed bed stage. (Vaughan)

Control measures

As in black rot, a large part of the infection is derived from the organism carried with the seed. In the case of black-leg, however, the fungus is beneath the seed coat and thus not affected by ordinary treatment. Dr. J. C. Walker in experimental work (1) has shown that treating with hot water, 50° C. (122° F.) for 30 minutes will kill the fungus. The treatment is so drastic that the viability of the seed is reduced materially, and should not be practiced excepting when the known presence of black-leg makes it imperative. The larger seed producing companies are beginning to take precautions against having the mother seed stock infected, and it will probably be only a matter of time before the disease will be greatly reduced in this manner.

Literature
(Cited)

1. Walker, J. C. The hot water treatment of cabbage seed. Phytopath. 13: 251-253. May 1923.
_____ Seed treatment and rainfall in relation to the control of cabbage black-leg. U. S. Dept. Agr. Bul. 1029: 1-27. Mar. 1922.

Black mold or leaf spot caused by Alternaria brassicae (Berk.) Sacc.

Leaf spot was common in the following states: Connecticut, New York, Ohio, Delaware, Florida, Louisiana, and Wisconsin. It probably was present in nearly all the states east of Minnesota, but no records were received for this season. In previous years, leaf spot has been reported from every state east of the Mississippi River, excepting New Hampshire, Vermont and Tennessee. It has been reported from six states west of the Mississippi, namely, Louisiana, Minnesota, Kansas, Texas, Washington, and California. In New York in 1922 it was important in all parts of the state, but was present as an epidemic in the Cortland Valley. The loss was estimated at 2%. On Long Island in the cabbage seed district it always does injury as a seed pod spot. I. H. Vogel reported it as not serious in Suffolk County in 1922. In the other states the loss was only slight. In Louisiana it was first observed January 6; in Delaware, June 19 at New Castle; and in New York during July in the Cortland Valley.

Control measures

New York: Seed treated with $HgCl_2$ showed Alternaria when cultured. A 100% killing of Alternaria in the seed with hot water 56° C. (133° F.) for ten minutes. (Chupp)

References

A new Alternaria on leaves of cabbage and cauliflower is reported by Milbrath from California. He calls the organism, Alternaria oleracea n. sp.

Milbrath, D. G. Alternaria from California. Bot. Gaz. 74: 320-324. Nov. 1922.

Downy mildew caused by Peronospora parasitica (Pers.) De Bary

Downy mildew usually does no serious injury to grown plants, but it has proved very destructive in the seed beds, according to the following comments.

New York: Observed doing damage in cabbage and cauliflower plant beds. Observed also on cabbage being grown for seed where it seemed to do much damage. (E. E. Clayton, July 24)

I. H. Vogel of Suffolk County says 10% seed crop injured. Fairly favorable for its development in the early maturing fields which had quite heavy growth. (Chupp)

Virginia: Especially in plant beds but also in field, 75% of seedlings lost in plant bed. (Fromme)

Kentucky: Destroyed bed of young cabbage plants near Georgetown, following a few days of foggy, wet weather. (Valleau)

California: Reported from Oxnard, Ventura County, as causing serious injury to very young plants in seedbeds. Cotyledons are attacked and apparently destroyed, and plants are said to be killed. (Horne)

It was observed in Connecticut, New York, Pennsylvania, Virginia, Kentucky, South Carolina, Florida, Louisiana, Texas, Wisconsin, Iowa and California. In New York 1% loss was given, while no definite percentages were suggested for the other states.

Table 41. Earliest recorded appearance of downy mildew in 1922.

Date	Place	Date	Place
January 24	John's Island, S. Car.	June 7	Georgetown, Ky.
March 25	Dumbarton, Va.	June 10	Racine, Wis.
March 30	Louisiana	August 4	Storrs, Conn.

Other diseases

Ring spot caused by Mycosphaerella brassicicola (Duby) Lindau was observed in California. W. S. Fields writes: "Mycosphaerella brassicicola on cabbage, cauliflower and broccoli in the Colma District. No data as to amount of damage, disease can be found in every field in Colma District." D. G. Milbrath adds, "In San Mateo County, 90% severe infection. Loss 15% in field. Acreage 1000."

Slimy soft rot caused by Bacillus carotovorus Jones was reported from Vermont, New York, Pennsylvania, Delaware, Maryland, Mississippi, Ohio, and Wisconsin. In Vermont the loss was estimated at from 1 to 2%; New York - Nassau County - "Soft rot on cabbage seed stalks is causing severe loss in plantings of high priced seed strains. This may enter through maggot injury. (H. C. Odell. N. Y. St. Coll. Agr. Dept. Pl. Path. and Ent. Weekly News Letter, June 19, 1922); Delaware - "Breeding trials show certain strains very suscep-

tible." (Adams); Mississippi: "Reported from Port Gibson, Mississippi by Port Gibson Truck Growers Association as causing slight loss in the field and heavy losses in transportation. Several cars were a total loss on reaching the northern markets. Specimens were examined by me, and the disease in question is very likely Bacillus carotovorus soft-rot. This trouble was reported to this office on May 12." (Neal); Ohio - "Greatest losses have been noticed in shipments. Only an occasional report has come to us from the growers." (Thomas); and Wisconsin - "Abundant crop and only best was accepted for sale. Heads left in field went down rapidly after height of maturity." (Vaughan)

Soft rot or drop caused by Sclerotinia libertiana Fckl. was found in New York, South Carolina, Texas, Louisiana, and Indiana. It was not so destructive in New York as usual, but always causes a considerable loss in the kraut sections on late harvested cabbage. In Louisiana the loss was 3-5%. In the other states there was only a trace of injury. In Louisiana and South Carolina it was first seen in January; in Indiana it was noted in July.

Rhizoctonia solani Kuhn was responsible in Connecticut for a root rot and also damping-off of cabbage. In Nassau County, Long Island, Odell observed a similar root rot, and in Ohio, Thomas found the same damping-off. In Pennsylvania, Beach discovered Rhizoctonia causing a rot of cabbage heads, the loss being estimated as 7% for Philadelphia County.

A stem rot caused by Fusarium sp. was recorded by Dana of Washington. He also reported a non-parasitic internal black spot of cabbage.

Root knot caused by Heterodera radicicola (Greef) Müll. was reported by Taubenhaus as causing 2% loss in Texas. In previous years it has been reported from most of the Southern States.

An unknown head rot of cabbage was found in Washington and Wasco Counties, Oregon, by Barss.

There was one complaint, probably due to type of fertilization and cultivation, of leaves turning yellow and dying prematurely in fairly young plants. (Clinton, Connecticut)

Lack of heading. Lutman of Vermont had his attention called by local growers to the lack of heads on many of the cabbages and cauliflower. It was apparently due to weather and not to a parasitic organism.

General references

Harvey, R. B. Varietal differences in the resistance of cabbage and lettuce to low temperatures. Ecology 3: 134-139. Apr. 1922.

Pape, Heinrich. Kohlkrankheiten. Deutsche Landw. Pr. 49: 302-303. June 3, 1922.

BRUSSEL SPROUTS

Black-leg caused by Phoma lingam (Tode) Desmaz. was serious in some fields on Long Island. The loss was as high as 50% of the plants. (Clayton)

Black rot caused by Bacterium campestre EFS was also found on Long Island by Clayton. The disease was common.

CAULIFLOWER

Black rot caused by Bacterium campestre EFS resulted in serious losses to the cauliflower growers of Long Island. I. H. Vogel estimated that 40% of the crop in Suffolk County was injured, Clayton stated that, "Crop probably reduced a fifth by this one disease. Quality also affected."

Peppery spot caused by Bacterium maculicolum McCulloch was reported by Clayton (Long Island). "This spot has been very prevalent this year."

Black-leg caused by Phoma lingam (Tode) Desmaz. was present on Long Island where the loss it produced was estimated at 1 to 2%.

Club root caused by Plasmodiophora brassicae Wor. was found on Long Island and in Ohio.

Ring spot caused by Mycosphaerella brassicicola (Duby) Lindau was reported by Milbrath in California as follows: "In San Mateo County, 90% severe infection. Loss 15% in field. Acreage 2,000."

Stem rot caused by Sclerotinia sp. was present on plants started in hot beds and set out in market gardens at Indianapolis, Indiana. (Gardner)

CHINESE CABBAGE

"A new leaf disease of Chinese cabbage in Texas is found to be due to a leaf nematode." (Taubenhaus)

CRESS

Stem rot caused by Sclerotinia libertiana Fckl. occasionally was present in greenhouses in the eastern part of Massachusetts. (Osmun)

HORSE RADISH

White rust caused by Albugo candida (Pers.) Ktz. was observed near Newark, Burlington and Toms River, New Jersey. "Although there was heavy infestation of the white rust in some fields, there was no indication that any loss was produced." (Poole)

Leaf spot caused by Cercospora armoraciae Sacc. was observed in New Jersey and Illinois. Another leaf spot caused by Ramularia sp. was also mentioned by Anderson and Tehon of Illinois.

Root rot caused by Rhizoctonia sp. was reported from Washington and New Jersey. A similar root rot (cause undetermined) was found in Seneca County, New York. R. P. White names Thielavia basicola (B. & Br.) Zopf. as causing a root rot in Kansas.

Bacterial root rot caused by Bacillus sp. was reported from New Jersey by R. F. Poole as follows: "Observed near Newark and Burlington, 6% reduction in yield for State. This disease caused less loss than last year. Heavy loss occurred in storage pits just previous to the planting date. Diseased roots failed to germinate, causing many misses in some fields. A few diseased plants developed late in the growing season."

Mosaic was reported once to G. P. Clinton of Connecticut. He writes: "Apparently a new host for state. Failed to infect tobacco."

KALE

Yellows caused by Fusarium conglutinans Woll. was again observed in Marion County, Indiana. (Gardner)

MUSTARD

White rust caused by Albugo candida (Pers.) Ktz. was reported for the

first time from Illinois, where it was observed July 13 at Gallatia, Saline County, according to Anderson and Tehon. It was also observed in South Carolina, Florida, and Louisiana. In Florida white rust was very common and in Louisiana it caused rather large losses in the crop.

Powdery mildew caused by Oidium sp. was found in a few places in Florida by Burger.

Mosaic was reported from Louisiana and Indiana. Edgerton (Louisiana) stated that it was severe in some localities. Gardner (Indiana) called attention to the fact that it was the same mosaic that occurred on turnips.

Leaf spot caused by Cercospora sp. produced slight injury in Louisiana.

RADISH

White rust caused by Albugo candida (Pers.) Ktz. was present in Illinois, Minnesota, and Colorado. In no case was it of economic importance.

A powdery mildew, ascribed to Erysiphe polygoni DC. by Maneval was seen in Missouri.

Downy mildew caused by Peronospora parasitica (Pers.) De Bary was observed August 26, in Ogle County, Illinois.

Black root caused by Rheosporangium aphanidermatus Edson occurs in gardens about LaFayette, Indiana in the spring and fall. (Gardner)

Damping-off caused by Rhizoctonia sp. was found in Columbiana County, Ohio.

RUTABAGA

Black rot caused by Bacterium campestre (Pam.) EFS was reported from the northwest section of Wisconsin. It caused wilting of the leaves and browning of the bundles. E. E. Clayton found a similar trouble on Long Island.

References

Strang, R. B. Diseases of the Swede crop in Cumberland and Westmorland in 1921. Jour. Min. Agr. Gt. Brit. 28: 1093-1096. Mar. 1922.

Whitehead, T. Plant diseases. Rep. Exp. Univ. Coll. North Wales 1920-1921: 40-50. 1922.

_____ Varieties of Swedes resistant to finger-and-toe. Jour. Min. Agr. Gt. Brit. 29: 362-388. July 1922.

TURNIP

Rhizoctonia - Ohio. (Thomas)

Leaf spots - Cercosporella sp., reported from South Carolina and Louisiana; Macrosporium sp. reported from Ohio. Both unimportant.

White rust caused by Albugo candida (Pers.) Ktz. was reported by Taubenhaus as causing 1% loss in Texas.

Soft rot caused by a bacterium was observed in Ohio.

References

Gardner, Max W. and James B. Kendrick. Turnip mosaic. Jour. Agr. Res. 22: 123. 1921.

"Turnip (Brassica rapa) was found affected with a typical mosaic disease at South Bend, Indiana. The disease is communicable by rubbing and by inoculation

of wounds with expressed juice. The incubation period in January was 16 days. Radish (Raphanus sativus) is not affected and is not a 'carrier'." (Absts. from Bot. Absts. 10. Entry 1881. Feb. 1922)

Jones, S. G. A bacterial disease of turnip (Brassica napus). Jour. Agr. Sci. 12: 292-305. July 1922.

DISEASES OF CUCURBITS

CANTALOUPE

Leaf blight or leaf mold caused by Alternaria brassicae nigrescens Pegl. was present in Connecticut, New Jersey, Delaware, Maryland, Georgia, Texas, Arkansas, Ohio, and Indiana. In Maryland 20% loss is reported; in Texas, 2%; and in Indiana and some parts of Georgia, it was very serious. Control measures evidently consist in the application of fungicides or in the use of resistant varieties. Maryland: "A limited number of fields were sprayed and a few were dusted with Bordeaux. Spraying gave better results than dusting, but dust gave fair results." (Temple & Jehle); Indiana: "Noted on Tiptop and Rockyford varieties, Lafayette, in October on soils never before in cantaloupes. Gregory reports severe in Jackson and Vigo Counties. No control with insecticidal dust (calcium arsenate Gypsum)." (Gardner); Arkansas: "Only resistant varieties are used and injury is very small." (Elliott)

Bacterial wilt caused by Bacillus tracheiphilus EFS. According to the reports, bacterial wilt was somewhat more common than usual. It was present in New York, Delaware, Maryland, West Virginia, Arkansas, Ohio, Indiana, Illinois, Michigan and Kansas. A trace of injury was caused in Maryland, Illinois and Kansas, while in Indiana there was 3% reduction in the crop. The wilt seemed to have occurred in all the states almost simultaneously between July 7 and July 27. In Maryland the disease was confined mostly to the eastern half of the state, in Michigan it was in the southern half, and in Illinois it was especially prevalent in Madison County in the Poag station melon district.

Control

Ohio: Where Bordeaux mixture spray is consistently used little wilt occurs. This spray seems to act as a repellent for certain types of insects. (Thomas)

Anthracnose caused by Colletotrichum lagenarium (Pass.) Ell. & Hals. was probably present in all the cantaloupe districts of the United States, but the incomplete returns do not verify such a sweeping statement.

Some varieties are extremely susceptible.

Delaware: Limiting factor in production of Honey Dew melons in Delaware. Adams)

Indiana: Found serious on Tiptop fruit, Marion County, October 5. (Gardner)

Table 42. Occurrence, estimated losses, and dates of earliest appearance of anthracnose of cantaloupe in the United States in 1922, according to collaborators.

State	Prevalence compared with: Last Year	Prevalence compared with: Average Year	Estimated percentage loss, or importance.	Earliest appearance: Date	Earliest appearance: Place
Delaware	More	More		July 26	Laurel
South Carolina	More	More	10	June 15	Furman
Arkansas	Same		Trace	June	Hope
Ohio	Same	Less	Trace	July 22	Fairfield County
Indiana			Serious locally		
Wisconsin			Trace		
Kansas			Practically none		
Arizona			Common		

Reference

Link, G. K. K. and F. C. Meier. Anthracnose of musk melons. U. S. Dept. Agr. Dept. Circ. 217: 1-4. May 1922.

Other diseases

Mosaic was reported from Delaware, where it was first observed on Rocky Ford and Pearl Pink. Growers have failed to recognize its importance." (Adams) 'Gregory (Indiana) noted in June the relation between mosaic milkweed and mosaic in cantaloupe in Marion County on two farms. Diseased melons around mosaic weeds,- none around healthy weeds. No mosaic in field where no milkweeds occurred. At LaFayette, mosaic was severe in a field in which numerous milkweeds occurred. Melons had not previously been grown in this field. Also noted severe August 7 on another farm, where milkweeds abounded." (Gardner) In Ohio it was "Very severe locally, one case observed being definitely associated with the mosaic of milkweed in pasture land in an adjoining field." (Thomas)

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow. is reported only from eastern states,- namely, Connecticut, New York, New Jersey, Delaware, Maryland and Georgia. Where it occurs it is of extreme importance. Forty percent reduction in the crop was reported for Delaware, and 5% for Maryland.

Connecticut: A good season for this disease. Bad on the few vines seen. (Clinton)

Delaware: Downy mildew disease was the limiting factor in the cantaloupe production. Infection caused premature collapse of vines and not a field in the state was known to produce a normal crop. Considerable increase in acreage planted this season but only early plantings matured part of a crop. Heavy rainfall in July very favorable to prevalence of disease. Dusting work with copper arsenate dust was effective in maintaining vigor of vines but not thorough control of disease. (Adams)

Maryland: General in eastern half of state, reduced yield 5%. Controlled by spraying and dusting with Bordeaux. (Temple & Jehle)

(See also Pl. Dis. Bul. 6: 94. 1922)

Leaf spot caused by Cercospora cucurbitae E. & E. was observed at Houston, Delaware, June 28.

Fruit spot caused by Cladosporium cucumerinum E. & A. was reported from Massachusetts by A. V. Osmun.

Bacterial wilt caused by Bacillus tracheiphilus EFS - Wisconsin. (Vaughan)

Southern blight caused by Sclerotium rolfsii Sacc. resulted in 1% loss in Texas (Taubenhaus), 5 to 8% loss in Louisiana (Edgerton), and 20% loss where observed in South Carolina (Ludwig and Tisdale).

Root knot caused by Heterodera radicicola (Greef.) Müll. was prevalent in Texas, where it resulted in 1% loss, and in Arizona.

A wilt, the cause of which was not determined, was troublesome in some parts of Marion County, Oregon, according to Barss.

Hail injury was very severe in some sections of Delaware, according to Adams, who says: "Many fields a complete loss through leaf and fruit injury.

Spray injury was reported by Jehle from Maryland as follows: "Copper lime calcium arsenate dust caused some burning of cantaloupes on Eastern Shore. Not severe."

Reference

Hemmi, Takewo. On the occurrence of Mycosphaerella wilt of muskmelons in Japan. Phytopath. 12: 394-397. Aug. 1922.

CITRON

Anthracnose caused by Colletotrichum lagenarium (Pass.) E. & Hals. was reported from Canon, Delaware. (Adams)

CUCUMBER

Wilt caused by Bacillus tracheiphilus EFS

Bacterial wilt was present in its usual virulence, causing large losses in many states. The disease was observed in nearly every cucumber district but did most damage in the northern Mississippi Valley.

Table 43. Prevalence and importance of, and estimated losses from bacterial wilt of cucumber in 1922, according to collaborators.

State	Importance	Estimated % loss	State	Importance	Estimated % loss
Massachusetts	General		Ohio	Maximum 50%	
Connecticut	One report		Indiana	Worst disease of crop	
New York	Less				
Maryland		Trace	Illinois	Infection slight	
Virginia	General		Wisconsin	Widely present	8
Kentucky		22	Michigan	Many reports	
South Carolina	Unimportant		Minnesota	Unimportant	
Texas		2	Iowa		10
Arkansas	Most conspicuous		Colorado	Unimportant	

Table 44. Earliest appearance of wilt as observed by collaborators in 1922.

Date	Place	Date	Place
May 22	Hennepin County, Minnesota	July 13	Madison, Wisconsin
June 10	South Carolina	July 20	New Haven, Connecticut
July 10	New York	July 24	Henry County, Ohio
July 13	Gordonsville, Virginia	August 5	Allen County, Indiana

New York: Caused much early damage, but has not been active since last of July. (Clayton)

Arkansas: The most conspicuous cucumber disease. Apparently does more damage. (Elliott)

Control

In a great measure, the control of wilt depends upon the control of the insect carriers. Regarding this, W. H. White (1) writes as follows:

> "The success met with by Campbell in combating Diabrotica soror Lec. and D. trivittata Mannh. in California by the use of nicotin sulphate mixed with kaolin and lime (E. S. R., 44, p. 651) led the author to conduct experiments with D. vittata. They were carried out at the Arlington Farm, Rosslyn, Va., during the early summer of 1921, the striped cucumber beetle being very abundant on cucurbits.
>
> "A dust containing nicotin sulphate at strengths of 4, 6, and 8%, equivalent to 1.6, 2.4, and 3.2% of nicotin, respectively, was used. The mixture containing 4% of nicotin sulphate proved as effective as higher percentages and is recommended. The dust was found to act as a repellent as well as a contact insecticide, and when properly applied drives the insects from the cracks in the soil at the base of the plants, thereby preventing serious injury. Directions are given for preparation of the dust, which should consist of 75% kaolin and 25% lime. It must be applied so as to prevent the beetle from escaping by flight, and this can be accomplished by a duster that will throw a good volume of dust quickly and with force. A cheesecloth sack or a knapsack-bellows type of duster is effective on small areas." (Abst. from Exp. Sta. Rec. 47. Abstract No. Dec. 22, 1922.)

New York: Careful spraying and dusting demonstrations were conducted but only a slight amount of wilt occurred even in the checks. (Chupp)

Kentucky: Considerable success was obtained in control of striped cucumber beetle with a spray of arsenate of lead 2 pounds, slaked lime 4 pounds, and water 25 gallons. (Gardner)

References

(Cited)

1. White, W. H. Nicotine dust for control of the striped cucumber beetle. U. S. Dept. Agr. Dept. Circ. 224: 1-8. 1922.

(Not cited)

Doolittle, S. P. Comparative susceptibility of European and American varieties of cucumbers to bacterial wilt. Phytopath. 12: 143-146. Mar. 1922.

Mosaic

Mosaic or white pickle is a close second to bacterial wilt in its destructiveness.

> "Investigations of the cucumber mosaic disease made during the past year show that it is carried over winter by the common perennial milkweed, as well as the wild cucumber. Both, therefore, according to the United States Department of Agriculture, are a menace to the growing of cucumbers, muskmelons, and related vine crops." (U. S. Dept. Agr. Clip Sheet 197. April 3, 1922)

New York: Present but not to noticeable extent. The downy mildew epidemic has probably masked much mosaic. (Clayton)

Illinois: We have trouble with cucumbers from mosaic, so much so that we are waging a campaign this spring to destroy all milkweek in this vicinity as well as to get better control of the striped cucumber beetle together with melon lice that might do any spreading of the disease. (E. A. Bierbaum)

Indiana: Statewide. Noted August 14 at LaFayette on late cucumbers planted too near diseased cantaloupe crop. Undoubtedly it is the accumulation of mosaic in the perennial weed flora (milkweeds) that has driven pickle salting stations out of one region after another. (Gardner)

Michigan: Reported from Big Rapids section. (W. W. Gilbert)

Wisconsin: Chief limiting disease factor in production. Especially bad in central and southern part of state. Thirty varieties tried,- all equally susceptible. Found also on wild cucumber, all cultivated cucurbits except watermelon and citron, on milkweed. (Vaughan)

Control measures

> "The eradication of the wild cucumber for a considerable area around cultivated cucumber fields has given encouraging results in controlling mosaic, and it is believed that the combined eradication of wild cucumber and milkweed may prove a practical means of further control." (U.S. Dept. Agr. Clip Sheet 197. Apr. 3, 1922)

Table 45. Prevalence and importance of, and losses from cucumber mosaic in 1922, according to collaborators.

State	Importance	% loss	State	Importance	% loss
Connecticut	Saw only one case		Ohio	Present	
New York	Common		Indiana	Statewide	
Delaware	Very prevalent		Illinois	Important	
Maryland		Trace	Michigan	Present	
Kentucky	Important	7	Wisconsin	Destructive	
Louisiana	Considerable		Minnesota	Very important	
Texas		Trace	Iowa	Very bad	20

Angular leaf spot caused by Bacterium lachrymans EFS and Bryan

Angular leaf spot was reported from Connecticut, Florida, Indiana, Wisconsin, Minnesota, and Iowa. In nearly all cases it was relatively unimportant. Gardner (Indiana) stated that it was "no longer a factor in the pickle crop, as a result of seed disinfection." Vaughan (Wisconsin) said that "Leaf spot has been conspicuous by its absence for several years." In Florida, however, Burger still finds injury: "This disease was present in several cucumber growing regions. The disease was reported from the markets showing that considerable damage was sustained during the shipping of the product."

References

Meier, F. C. and G. K. K. Link. Bacterial spot of cucumbers. U. S. Dept. Circ. 234: 1-5. Aug. 1922.

Anthracnose caused by Colletotrichum lagenarium (Pass.) Ell. and Hals.

Anthracnose was observed in Massachusetts, New York, Maryland, South Carolina, Georgia, Ohio, Indiana, Illinois, Iowa and Wisconsin. It doubtless occurred in many other states but was not reported. Although reported as causing 8% loss in South Carolina and 1% in Iowa, it was generally not such an important disease as were wilt, mosaic or even mildew. According to Ludwig, Tisdale estimated 5 to 15% loss in the commercial sections of Bamberg, Allendale and Hampton Counties, South Carolina. Gardner (Indiana) wrote that it "occurs in Indianapolis greenhouses where overhead watering is practiced. It persists in the soil." McHatton (Georgia) - "Common and serious in some fields and gardens.

Control

Indiana: By careful watering with a hose it is being controlled in infested houses. (Gardner)

References

Bewley, W. S. Report of the mycologist. Ann. Rep. Exp. & Res. Sta. Nursery & Mark. Gard. Industr. Dev. Soc. 7 (1921): 32-41. 1922.

Bewley, W. S. Anthracnose of the cucumber under glass. Jour. Min. Agr. Gt. Brit. 29: 469-472. Aug. 1922.
"Colletotrichum oligochaetum, now most important leaf spot of cucumber in Great Britain."
_____ Anthracnose of the cucumber under glass II. Jour. Min. Agr. Gt. Brit. 29: 558-562. Sept. 1922.

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow..

Downy mildew was present in epidemic form in the cucumber sections of the far eastern states, such as Massachusetts, Long Island, and Delaware.

Table 46. Prevalence and importance of downy mildew in the United States in 1922, as estimated by collaborators.

State	Importance	Estimated % loss	State	Importance	Estimated % loss
Massachusetts	An epiphytotic	25	Maryland	Eastern Maryland:	2
Connecticut	Present		Florida	Quite prevalent:	
New York	Very important on Long Island	10-15	Mississippi	Considerable in: Prentiss Co.	
Pennsylvania	In Center and Huntington Counties		Ohio	Negligible	
			Illinois	No report	
Delaware	In Late planted fields		Wisconsin	None reported	

In all of the eastern states the mildew appeared between August 5 and 15.

Control measures

New York: (Long Island) - Universal over Island except at extreme eastern tip (Orient Pt.). Extremely destructive, only very thoroughly sprayed fields escaping. (Clayton)

Florida: This disease was quite prevalent in the state in the cucumber growing regions. At these places where systematic spraying was carried on with Bordeaux mixture the vines remained green two weeks longer than where the vines were not sprayed. (O. F. Burger. Aug. 1922)

Other diseases

Scab caused by Cladosporium cucumerinum Ell. and Arth. was found in Marinette County, Wisconsin on 15-20% of the pickles coming to salting stations. The foliage was very free from the spots, the disease being less than in 1921. (Vaughan). It also did considerable damage in Erie County, New York (Chupp), and "occurred to a considerable extent in the vicinity of Big Rapids, Michigan" (W. W. Gilbert).

A leaf spot attributed to Alternaria brassicae Pegl. caused 5% injury in eastern Maryland, according to Temple and Jehle. A spot attributed to

Macrosporium cucumerinum E. & E. caused serious loss in some fields in southern New Jersey.

Powdery mildew attributed in Massachusetts to Erysiphe polygoni DC. and in Colorado to Erysiphe cichoracearum DC. was found in the above named states. No injury from it was observed.

Wilt caused by Fusarium vasinfectum Atk. was one of the minor cucumber diseases in Ohio.

Stem rot caused by Sclerotinia libertiana Fckl. was observed in the far separated states of Massachusetts, Idaho and Washington. It was not a serious disease in any case.

Damping-off caused by Pythium debaryanum Hesse was common in greenhouses and cold frames in Massachusetts.

The slime mould, Physarum cinereum (Batsch.) Pers. completely covered some young plants in Schnectady and Tompkins Counties, New York. The organism was determined by Dr. Frank Wann.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported from Mississippi, Louisiana, Texas, Ohio, and Washington. In Ohio the infection was found only in greenhouses. Steam sterilization was an efficient control, according to Thomas. In Louisiana the disease was important in places; in Texas there was a 2% loss; and in Wayne County, Mississippi, a ten-acre planting was seriously injured.

White tips - In one greenhouse in Connecticut the cucumber vines showed white tips due to hydrocyanic acid gas fumigation.

References

Milbrath, D. G. Control of diseases of cucumbers in greenhouses. Month. Bul. Dept. Agr. Calif. 11: 430-437. May-June 1922.

PUMPKIN

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow was reported once from Middletown, Connecticut.

Mosaic - Connecticut. "Bad; difficult to grow cucurbits in this garden on account of mosaic. Infection experiments, however, not satisfactory." (Clinton)

SQUASH

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow was generally present in Delaware. Adams says that squash is more resistant than cantaloupe.

Mosaic was everywhere in Louisisna, causing considerable loss. (Edgerton). In Texas there was a trace of the disease. (Taubenhaus).

Wilt caused by Bacillus tracheiphilus EFS was very common in New York causing 5% loss of the squash crop. It was also found in Ohio, Wisconsin and Iowa.

Fruit drop (cause undetermined) was mentioned by Dana of Washington.

Frost injury. Early plants in the Imperial Valley, California, were badly injured by frost. (C. L. Brown)

Wilt caused by Fusarium spp. - 1% loss in Texas. (Taubenhaus)

Rhizopus rot - "In Texas, great losses have requently occurred on squash fruit in the field." (Taubenhaus)

Anthracnose caused by Colletotrichum lagenarium (Pass.) E. & H.

Anthracnose was one of the serious watermelon diseases in 1922. In the past it has been reported from nearly every state where watermelons are grown. The loss which resulted was often very high, as may be judged from the few following reports of this season: Delaware, 1%; Maryland 10%; South Carolina, 25%; Arkansas, 3%; and Kansas, 2%. (See also Plant Disease Bulletin 6: 94. 1922)

Table 47. Importance and geographic range of anthracnose in 1922, according to Plant Disease Survey collaborators.

State	Importance and geographic range
New Jersey	Common in Salem, Cumberland and Gloucester Counties
Delaware	Seriously affected in some sections
Maryland	Eastern half of state
Virginia	General, especially around Smithfield
West Virginia	Destructive, especially in Ohio Valley
Kentucky	Dry weather controlled it
South Carolina	Very important; general
Georgia	Very serious
Mississippi	Especially severe in Jones County
Louisiana	Slight infection
Arkansas	Fairly severe
Ohio	5% fields in southern Ohio show disease
Indiana	Serious locally, dry weather checked disease
Missouri	Spraying gave big increases
Kansas	Maximum in one field, 85%
Arizona	Serious in North Arizona, 50% loss in Navajo and Apache Counties

Control methods

"In the almost total absence of liquid power sprayers in the Missouri melon territory several commercial growers were advised to apply a copper compound as a dust in a good hand operated bellows-type duster.".....

"On the field of 150 rows from which one and one-half cars were loaded under the association rules, only 32 rows received insect protection throughout the season and nineteen of the 32 rows received copper dust. Over 80% of the merchantable melons loaded from the 150 rows came from the 32 dusted rows and over 90% of the large melons (over 36-pound average) came from these 32 rows.

"From our notes it is apparent that the second application (one week after first melons have set on vines) is the calyx spray of the watermelon for when that was omitted any number of applications thereafter showed little signs of checking the disease." (Cardinell, H. A. and E. M. Page. Tests in curbing melon pests. Better Fruit 16[11]: 6, 17-19. May 1922.

Reference

Cardinell, H. A. One season's dusting against cucumber beetles and anthracnose of watermelons in Missouri. Proc. Amer. Soc. Hort. Sci. 18 (1921): 123-130. 1922.

Stem end rot caused by Diplodia sp.

Stem end rot is primarily a transportation trouble, though Burger reports that he has found it causing a wilt of the vines. It has been reported from Maryland (1% loss) and the following three states.

Georgia: Common, controlled in melons shipped through organizations, ruined many cars where stems were not treated. (McHatton)

Florida: Stem end rot was reported from several sections this past year. The fungus was also found causing a wilting of the vines attacking them at the ground line. (Burger, August 1922)

Arkansas: Little field injury, mostly in transit. (Elliott)

Blossom end rot (cause unknown)

Blossom end rot is of extreme importance in some states. According to some collaborators the drouth seems to be a factor in producing it. In Kentucky, according to Valleau, "blossom end rot is very prevalent reducing the number of melons by one-half or two-thirds in some fields, occurring both in very small melons and on large ones; may be associated with long dry period." Charles Drechsler, in his article "A new blossom-end decay of watermelons caused by an undescribed species of Pythium," (Phytopath. 13: 57. 1923) gives the following information:

> "At Arlington Farm, Virginia, 1922, a field disease of watermelons, manifested externally by a dark chocolate brown of bluish brown discoloration, that progresses from the blossom region toward the stem end, was decidedly destructive. The rind assumed a watersoaked, candied appearance, while the discolored pulp became flaccid in consistency. The diseased parts were invariably occupied by a fungus closely resembling Pythium artotrogus DeBary in size of oogonium and oospore, and in the presence on the oogonial wall of narrowly conical radial processes. However, while in Pythium artotrogus fertilization is always accomplished by a "hypogynal" antheridium, in the watermelon parasite it is effected more frequently by multiple branch antheridia, of which from one to four are usually present. The stalk antheridia, moreover, are considerably shorter, their length and diameter being approximately equal. The fungus may occasionally enter the watermelon by wounds or by lesions caused by other fungi. Infection resulted from inoculation with pure cultures under the rind.

"The watermelon decay attributable to Pythium debaryanum Hesse, which also was abundantly present in the field, is distinguished from the new trouble by light brownish discoloration of the exterior, bleaching of the pulp to pale pink, exfoliation of the epidermis on slight chafing, a peculiar strong marshy odor, and the frequent presence on the moist under-side of extramatrical mycelium."

Table 48. Prevalence and importance of blossom end rot in 1922, according to collaborators.

State	Prevalence compared with: Last Year	Prevalence compared with: Average Year	% loss	Importance and geographic range
Delaware	Less	Less		Slight, general
Kentucky	More	More	60	
Texas			1	Very prevalent
Arkansas	Same	Same	5	Very common and severe
Indiana	More	More		Drouth favored this trouble
Iowa	Same			Important

Wilt caused by Fusarium niveum EFS

Evidently wilt was fully as destructive, if not more so, than in 1921 and 1920. Texas, Florida, Indiana, Illinois and Kansas suffered the heaviest losses.

Table 49. Prevalence and geographic range of wilt with losses incurred therefrom in 1922.

State	Prevalence compared with: Last Year	Prevalence compared with: Average Year	% loss	Remarks
Maryland	Same	Same	t	
Virginia				Slight loss at Smithfield
West Virginia	Less			Observed only in Ohio Valley
South Carolina	More		t	
Georgia				General in gardens
Mississippi				Warren and Madison Counties, severe locally.
Texas			8	Very prevalent
Florida				Very prevalent
Ohio				Only one report
Indiana				A limiting factor
Illinois	More	More	25	Many fields were a total loss
Iowa				Serious locally
Kansas	More	More	3	
Arizona	More			Several places in South Arizona

Table 50. Dates of earliest appearance of wilt in 1922.

Date	Place	Date	Place
June 12	New Brookland, South Carolina	July 18	Smithfield, Virginia
June 29	Fulton County, Indiana	July 20	Ashland County, Ohio
		July 24	Cloud, Kansas

Other diseases

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow. was reported from Delaware and Louisiana. In the former state the loss was 20%, being much greater than in previous years. J. F. Adams says it was "the limiting factor in maturing crop." Edgerton reports in a similar manner: "Very severe in southern Louisiana this season, defoliating and killing the plants just before ripening season. In many cases the fields appeared black."

Mosaic, or a disease resembling it, is mentioned by Jehle as attacking vines in Caroline County, Maryland. Five percent of the plants were affected. There were distinct leaf characters of mosaic, the vines were dwarfed and being without melons, were worthless.

Root knot caused by Heterodera radicicola (Greef.) Müll. was observed at Summerville, South Carolina, May 20.

Leaf spots caused by Alternaria brassicae nigrescens Pegl. did slight injury in Indiana. Another leaf spot caused by Cercospora citrullina Cke. resulted in 1% loss in Texas.

Rhizoctonia on watermelon is reported as a new disease in Washington Agricultural Experiment Station Bulletin 167, 1922, by F. D. Heald.

Thielavia basicola (B. & Br.) Zopf. on watermelon is dealt with by McKay in an abstract in Phytopath. 12: 445. 1922.

A wilt (cause undetermined) was mentioned by Barss - "A great deal of complaint about watermelon and cantaloupe wilt in Willamette Valley and southern Oregon. Considerable damage reported in Douglas County on watermelon."

Drought injury was recorded by Dana of Washington.

"Hail injury upon young fruit prevented maturing in some sections of Delaware and reduced marketable value." (Adams)

An interesting case of abnormal proliferated blossoms is reported by Taubenhaus of Texas. No causal agent is assigned.

General reference

Orton, W. A. and F. C. Meier. Diseases of watermelons. U. S. Dept. Agr. Farmers' Bul. 1277: 1-31. 1922.

DISEASES OF COTTON

Anthracnose caused by Glomerella gossypii (Southw.) Edg.

The reports of 1922, as compared with those of the previous two seasons, show that anthracnose was less destructive than usual. It seemed to be fairly uniformly distributed over the cotton area. The injury resulted

from spotted bolls producing infected seed and a poor grade of line. The following report from Mississippi by Neal is characteristic of the general situation in other states.

> "A serious outbreak of the disease has been reported from Neshoba, Clarke, Lee and Hinds Counties." (September 1)
>
> "Although not as widespread as in former years, a few localities reported serious outbreaks of the disease."

(See also Pl. Dis. Bul. 6: 109, 147, 153. 1922)

Table 51. Prevalence and importance of cotton anthracnose in 1922

State	% loss	Remarks
South Carolina	1	Comparatively unimportant
Georgia	1	
Florida		Did no great damage
Mississippi	2	Prevalent in many parts
Louisiana	3	Abundant
Texas	.5	Traces - unimportant
Arkansas	.5	Little importance
Tennessee	2	

The earliest appearance of the disease was during July in Mississippi and Louisiana; August 15, in South Carolina, and in September in Arkansas.

No differences in varietal susceptibility were suggested nor were control measures mentioned.

Wilt caused by Fusarium vasinfectum Atk.

Wilt is one of the most serious diseases of cotton, having been reported in the past from nearly every cotton-producing state. During 1922 reports were received from seven of these states. The amount of wilt was the same, or possibly less than usual.

Table 52. Prevalence and importance of cotton wilt in 1922, according to collaborators.

State	Percentage loss	Remarks
South Carolina	5	General over state, more than usual.
Georgia	2	Mostly in coastal plain section.
Mississippi	5	Reported from practically all over the state.
Louisiana	2	Common, but not so serious as usual.
Texas	3	Prevalent in light sandy soils.
Oklahoma		Reported in Carter County.
Arkansas	5	Less. Little resistant cotton grown.

Table 53. Dates of earliest appearance of cotton wilt in the United States in 1922, according to Plant Disease Survey collaborators.

Date	Place	Date	Place
April	Scott, Arkansas	June	Louisiana
June 6	Olav, South Carolina	July 7	Greenville, Mississippi

Control

The use of resistant varieties is the only proven method for the control of wilt. Elliott and Crawford (1) recommend that seed from infected fields should not be used for planting. Rast (2) obtained very promising preliminary results by heavy applications of potash fertilizers. These are to be repeated.

South Carolina: Estimated yield reduction partly accounted for by fact that lower yielding varieties must be raised on infested soil. (Ludwig)

Georgia: Use of wilt resistant varieties where rotation is practiced has largely done away with injury from this source. (Childs)

Mississippi: Delta type Webber was quite susceptible in Delta parts this season. Del Tos and Express 350 are fairly resistant. These are largely planted in the Delta. The resistant hill cottons largely planted are Lewis 63, TriCook, Trice and Covington Toole. (Neal)

References

(Cited)

1. Diseases of plants. Arkansas Sta. Bul. 181: 88-94. 1922.
2. Rast, L. E. Control of cotton wilt by the use of potash fertilizers. Jour. Amer. Soc. Agron. 14: 222-224. Sept. 15, 1922.

Angular leaf spot caused by Bacterium malvacearum EFS

Angular leaf spot, though common, was of much less importance than either wilt or anthracnose, except possibly in Georgia and Arizona where the disease caused heavy losses.

Table 54. Prevalence and importance of angular leaf spot in 1922.

State	% loss	Remarks
South Carolina	Trace	General - unimportant
Georgia	3	
Tennessee	1	
Florida		Abundant in western part of state
Mississippi	1	Same - unimportant
Louisiana	1	Common as usual
Arkansas	1	Less

State	% loss	Remarks
Texas	2	Severe in some localities
Missouri		One report, occurrence general
Arizona	5-10	

(See also Pl. Dis. Bul. 6: 63, 109, 147, 138-139. 1922)

The nature of the injury included defoliation, black-arm, shedding, boll rot, and lint stain.

The dates of earliest appearance were given as follows: Bamberg, South Carolina, June 6; Louisiana, July 20; Scott, Arkansas, April; Caruthersville, Missouri, July 11; and Arizona, April 20.

Control measures

The following two reports on the control of cotton angular leaf spot are given by Elliott of Arkansas, and Brown of Arizona, respectively:

> "Acid delinting gives practically 100% control. Very little boll spotting this year due to drouth."

> "Sulphuric acid seed treatment almost entirely eliminates the disease."

References

Brown, J. G. Black-arm of cotton: a successful method of control. Arizona Agr. Exp. Sta. Timely Hints 142: 1-8. Oct. 20, 1922.

Welles, C. G. Identification of bacteria pathogenic to plants previously reported from the Philippine Islands. Philipp. Jour. Sci. 20: 279-285. Mar. 1922.

Texas root rot caused by *Ozonium omnivorum* Shear

The Texas root rot was reported from Texas and Arizona, in both states of which it caused much injury. The weather retarded its progress, so that the loss was not so heavy as in 1921.

Specimens of diseased cotton plants were sent from Mexico by Mr. W. Ohlendorf of the Federal Horticultural Board to J. J. Taubenhaus, who determined the disease as *Ozonium omnivorum*.

Life history of fungus

> "It was found that the fungus does not live over in the soil, nor on decaying organic matter, but that it requires a living root on which to pass the winter. Roots of cotton plants, wild morning glory, castor bean, okra, pepper, and probably many others afford a root host on which the Ozonium winters over. Successful inoculations were also reported for the first time, using *Ozonium omnivorum* and successfully infecting healthy cotton plants." (Taubenhaus, J. J. Abst. Atlanta meeting Feb. 20-22, 1922. Phytopath. 12: 250-252. 1922)

Fig. 10. Counties from which Texas root rot is reported by Taubenhaus.

Control methods

"In connection with the work at the San Antonio Experiment Farm, investigations were carried on for determining the value of fertilizers for the control of root rot in cotton. Results showed no effect in preventing the disease under the prevailing conditions. ..... Any beneficial effects of aeration were found to be of very short duration. Root rot was determined as occurring to a depth of at least 4 ft. Mulching had no effect on the control of the disease." (G. T. Ratliffe. U. S. Dept. Agr. Dept. Circ. 209: 32-33. 1922)

"The causal organism winters over on living roots of susceptible hosts.

> "Deep fall plowing does not control root rot because such a practice does not necessarily kill the cotton roots; neither does it always destroy the susceptible weeds, especially the small flowered pink morning glory, Ipomoea trichocarpa, which is so common in the black lands of Texas.
>
> "Likewise, crop rotation does not control root rot even though a three- or four-year system is adopted in which non-susceptible crops are grown. In this case, the failure at control is due to the fact that the causal organismis permitted to live over during the fall and winter months on roots of perennial weeds which are commonly found on the stubble land of the grain or cereal crops which are used in the system of rotation.
>
> "It is possible to control root rot by fall plowing or crop rotation provided clean culture is practiced not only during the growing season, but also during the fall and winter months. (Taubenhaus, J. J. and D. T. Killough. (Abstract) Phytopath. 13: 33. Jan. 1923)

Root knot caused by Heterodera radicicola (Greef.) Müll.

Although root knot was reported only from Georgia, South Carolina, Mississippi and Arkansas, the disease is widespread throughout the South and serious on cotton especially on sandy soils.

Other diseases

Blight caused by Ascochyta gossypii Sydow did some injury in Logan County, Arkansas but was checked by the dry weather. Elliott has published the following articles regarding this disease during the past year: "A new Ascochyta disease of cotton." Arkansas Agr. Exp. Sta. Bul. 178: 1-18. 1922. "The Ascochyta blight of cotton." Phytopath. 12: 250-252. 1922.

Rust caused by Aecidium gossypii E. & E. caused .5% loss in the Rio Grande Valley of Texas, and was found in one district of about 300 acres in Arizona. The loss was negligible.

Leaf spot caused by Cercospora gossypina Cke. Traces were observed by Taubenhaus in Texas.

Leaf spot caused by Alternaria sp. was present in all the cotton districts of Arizona.

Various boll rots were mentioned. Edgerton of Louisiana lists Olpitrichum carpophilum Atk. as being rather common. It was also collected by Wolf in North Carolina. Other organisms in Louisiana, Texas and Arkansas were Colletotrichum sp., Diplodia gossypina Cke., Fusarium sp., etc. In Arkansas there was much less boll rot than usual.

Sore shin caused by Rhizoctonia sp. was commented upon by Robert Stratton (Oklahoma) as follows:

> "Sore-shin of cotton was very bad in some fields this year affecting young plants and destroying some fields in just a few days."

Sooty mold (cause not determined) did some damage in Arkansas on dusted cotton following honey-dew secretions by aphids. The lint was blackened and its grade lowered.

"Sunburn more than ordinary, especially on bolls blackened by sooty mold. In many cases boll rots have followed the sunburn injury." (Elliott, Arkansas)

Potash hunger, according to reports, was very evident both in Mississippi and Arkansas in 1922. It is present every year in the cotton area and so common that most pathologists fail to make mention of it.

DISEASES OF SUGAR CANE

Mosaic

Mosaic evidently is increasing both in importance and in its geographical distribution. Reports were received from Florida, Georgia, Mississippi and Louisiana. It had previously been reported also from Alabama. According to the statement of Brandes (Pl. Dis. Bul. Suppl. 22: 387. 1922), the above five states include the entire area where mosaic has been recorded in the United States.

Louisiana: Becoming abundant in all sections of the sugar belt. (Edgerton)

Georgia: Loss of 30 to 40% in green and red cane in yield of syrup per acre. "Cayana 10" variety is 100% resistant and now comprises 50% of acreage in Grady County. (J. B. Wright)

Florida: Mosaic was prevalent in the western part of the state. On account of the prevalence of this disease the State Plant Board had to quarantine this region. (Burger)

Varietal susceptibility

A resistant variety of cane known as Kavangire has been discovered. This variety is grown commercially in Argentine and a large amount of seed cane was shipped from there to Porto Rico under the direction of the Bureau of Plant Industry. It has given such good results on the Island that the acreage planted to it is increasing rapidly. Other varieties immune to the mosaic disease have been found, but they are the slender long-season varieties not suited to growing for sugar production in the United States. (See U. S. Dept. Agr. Clip Sheet No. 227. Oct. 30, 1922)

References

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Red rot caused by Colletotrichum falcatum Went.

Red rot was found in Georgia, Florida and Louisiana. J. B. Wright of Georgia stated that there was a loss of 10% in the seed beds of cane carried over the winter for planting. Burger, of Florida Agricultural Experiment Station, makes the following statement:

> "Red rot was prevalent in all the sugar cane districts this past year. In several cases the origin of the disease was traced to a certain locality which was badly infected and making a business of selling their cane for seed purposes."

Edgerton estimated the loss in Louisiana as 2 to 3%.

Control measures

The following measures are recommended by Burger (1) in controlling red rot:

> "In order to control this rapidly spreading disease:
> "1. Plant only healthy canes.....
> "2. As an extra preventive dip the canes selected

for seed into Bordeaux mixture just before planting...

"3. Whenever possible plant the canes in the fall instead of bedding them for spring planting.....

"4. A method of dealing with the disease that has been practiced in the West Indies is to plant some other variety not subject to red rot.

"5. Burn all trash in the old bed and all diseased cane."

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Root rot caused by Marasmius plicatus Wak.

The following quotation from P. A. Yoder's article in Facts About Sugar 15: 402-405. November 11, 1922, is interesting:

> "Root rot while not a very aggressive parasite, sometimes does considerable damage to the growing crop of cane, especially during damp weather, either alone or in conjunction with other parasites. This fungus usually develops on the shaded part of the stalk near the ground. In its earlier stages, and during wet weather, it can be detected as a slimy formation between the leaf sheaths and the stalk near the ground. Later, as the cane approaches maturity, and during dry weather, the slime dries up and these lower leaf sheaths become cemented to the stalk with a white mold."

It was reported in 1922 only from Louisiana where it caused heavy loss in the more poorly drained sections, the percentage being estimated as 5 to 10% by Edgerton.

Other diseases

Leaf spot caused by Cercospora vaginae Kr. was reported as occurring generally in Florida.

White band is reported by O. F. Burger from Florida as follows:

> "White band of cane was reported from several districts. This is a condition of the leaf represented by a white band 2 inches wide extending across the leaf. The cause for this is not known. Some express the opinion that it is frost."

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DISEASES OF SUGAR BEETS

Leaf spot caused by Cercospora beticola Sacc.

The leaf spot was about the same as usual in its severity, although in Kansas, Stokdyk reports 10% injury and in Utah, Richards stated that the disease is becoming more widespread. It was reported this season from Michigan, Iowa, Wisconsin, Kansas and Utah. In the past it has been reported from every state where sugar beets are grown commercially, although it has never been so severe in the western sugar beet states as it has been in the central and north central states.

Michigan: Occasional fields reported badly blighted. In nearly all cases this was associated with failure to rotate crops. (Div. of Bot. M. A. C.)

Wisconsin: Found in every field, but not enough to cause loss. Found more in low spots. (Vaughan)

Utah: Severity about as last year, but becoming more widespread. Still confined to Provo and closely surrounding districts. A loss but no definite percentage determined. (Richards)

Control

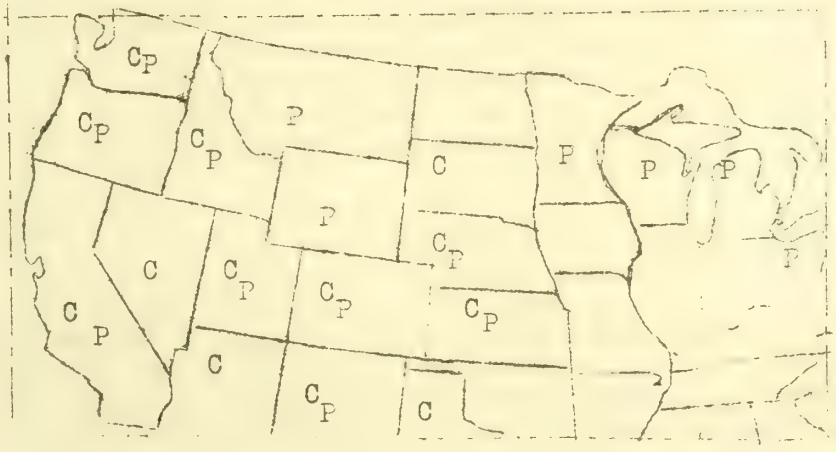
Kansas: Some injury this year, perhaps 10%. Spraying with Bordeaux mixture seems to be checking it to some extent. Complete records not available at this time. (E. A. Stokdyk)

Colorado: Appeared later than usual, hence did less damage. Spraying with bordeaux distinctly checked the disease. (C. O. Townsend)

Curly top (cause not determined)

Curly top in the past has been reported from the following western states: Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Colorado, New Mexico, South Dakota, Nebraska, Kansas, and Texas. The 1922 reports came only from California, Idaho and Kansas. In the last named state the injury was not serious and in Idaho, Hungerford estimated the loss at 3%. It was severe in some fields but not general in Utah and Colorado in 1922. Eubanks Carsner, in a letter January 7, 1922 from California, wrote:

> "In regard to curly top I may say that in general my impression is that the damage was less in 1921 than in the preceding season and very much less than in 1919. Notwithstanding this fact there was a great deal of the disease present. One of the sugar companies informed me that in their most inland region of one of the coastal valleys, 3000 acres were ploughed out before thinning because of the amount of disease, and the number of leafhoppers present indicated that the crop would not be worth harvesting. It may be of interest to note in this connection that sugar beet growing has been practically limited to the cooler coastal districts by the enormous amount of damage caused by curly-top in the interior districts."



C=States from which curly top of sugar beets has been reported.

P=States from which Phoma betae has been reported.

Fig. 11. Distribution of curly top and Phoma betae on sugar beets. Taken from the data available (up to and including 1922) in the files of the Plant Disease Survey Office.

Scab caused by Actinomyces scabies (Thax.) Güssow, was mentioned in reports as follows:

> Ohio: Presence of the disease noted in many localities. An economic factor in only two fields. (R. C. Thomas)
>
> Utah and Idaho: Some beets from Clearfield, Utah, have been diagnosed and scab reported. I do not know how extensive this condition is but it is probably limited. However, we have indications of some in Idaho. (Dean A. Pack)

Crown gall caused by Bacterium tumefaciens EFS & Town. was reported several times from Paulding County, Ohio. The disease was of no economic importance.

Mosaic (cause undetermined) was found doing slight injury in Indiana and Kansas.

Phoma rot caused by Phoma betae (Oud.) Fr. was not so prevalent in Idaho and Utah as usual. The severity of the disease apparently is correlated with the temperature and rainfall. Richards (Phytopath. 12: 443. 1922) says:

> "During the past season of 1921 a definite late blight of the sugarbeet became seriously epidemic throughout the northern part of Utah and southern Idaho. In Cache Valley, with a total acreage of 27,456 acres, 50 percent of the fields were diseased. The disease in the field varied in severity from a fraction of 1 percent of the beets destroyed to a total destruction of the crop. Many fields in the district were left unharvested, while others scarcely paid the expense of digging. The loss in the valley alone aggregated approximately two-thirds of a million dollars.
>
> "The available evidence indicates that the trouble is possibly identical with Phoma root-rot described by Edson and by various European workers. Data obtained from a study of this and similar but less severe epidemics of the disease in the Logan factory district during 1917 to 1919, show that such epidemics are favored by drought, and locally at least, are closely correlated with abnormally low precipitation during the months of June and July."

Crown rot caused by Rhizoctonia sp. was observed in Wisconsin. It was present in low, wet fields of Dodge County where in one field a third of the plants showed rot. A trace of a similar trouble, reported under the term heart rot, was noted in Iowa. Still another name, dry rot canker, was used in Cache County, Utah, where the trouble was less important than in 1920 and 1921.

Considerable loss due to damping-off caused by Pythium debaryanum, was produced in the Ohio sugar beet district. The disease was favored by the extreme wet weather in the spring season. (R. C. Thomas)

Seedling rots caused by Phoma, Pythium, and Corticium vagum were very serious in a number of fields in certain sugar beet areas. They, however, were less than in 1921. As high as 82% infection was determined during the spring in Utah. Such fields were usually plowed up, re-seeded or sown to other crops. The actual reduction in yield from this disease is difficult to determine as indirect effects are so numerous. It is hoped that another year will yield results on this point. (B. L. Richards)

DISEASES OF TOBACCO

Wildfire caused by Bacterium tabacum Wolf & Foster

The first report of wildfire came from North Carolina in 1917. Since then, as the Plant Disease Survey records show, it has spread in the manner its name would indicate. Each succeeding year new states or new counties were invaded, at least the disease was observed in them for the first time. In 1922 it was found in three new states - New Hampshire, New York and Florida - and was recorded in three additional counties in South Carolina,- namely, Georgetown, Clarendon and Aiken. It is now present in sixteen states.

Table 55. Prevalence and importance of wildfire in 1922.

State	Prevalence and importance
Massachusetts	Extremely serious
New Hampshire	Present
Connecticut	Present, less than last year
Pennsylvania	In Lancaster County - worse than in 1921 - loss 2%
New York	Serious on some Chemung County farms - loss 1-2%
Maryland	Serious in Prince Georges County on individual farms
Virginia	Possibly present
Kentucky	In 8% of the fields examined
South Carolina	More generally distributed than last year
Georgia	Reported from Tifton - not serious
Florida	In Gadsden County several fields
Wisconsin	90 farms in Dane County - estimated loss $500

Fig. 12. Distribution of wildfire of tobacco. Dots represent counties. Data obtained from all Plant Disease Survey reports, including 1922.

Connecticut: Has now appeared in all the tobacco regions of the state being found for the first time this year in Fairfield, Litchfield, (southeastern part) and Middlesex counties. (Clinton)

Maryland: Caused almost a total loss last spring and fields set with plants from infected beds are now showing as much as 40% financial loss. (Temple & Jehle, Sept. 15)

Virginia: Of 85 plant beds and 150 fields inspected not one case of wildfire was seen. No authentic reports received. I cannot believe that it has disappeared entirely from the state. It may have been present to a slight extent in the counties which were not visited by men from the department. (Fromme)

North Carolina: It is impossible to give any satisfactory estimate of the losses caused by wildfire. During 1917 (the first year the disease was definitely recognized) it was universally conceded by growers that this disease is the most destructive one which attacks tobacco. Losses, ranging from those which were inappreciable to those in which almost the entire crop was destroyed, were sustained in every locality where the disease was present. The problem of estimating the damage wrought is further complicated by the fact that in some sections the disease occurred on every farm, whereas in others it was present only in an occasional field. This lack of uniformity in destructiveness occurred also on the same farm, since certain fields were badly affected while others had little or none of the disease.

In 1918 wildfire was less prevalent than in 1917, and in none of the succeeding years has it been regarded as a trouble of major importance. In fact, it has appeared only in isolated areas and was confined to a few fields in any locality. It is interesting in this connection to note that no wildfire occurred during 1922 on the farms where the disease was first observed. The cause of this decrease in destructiveness and apparent disappearance of wildfire is not adequately known, but is a phenomenon which has been recorded in the case of a number of other plant diseases. (F. A. Wolf (2))

Florida: Wildfire was found in two small plant beds and three two-acre fields. One field was discovered ten days after the plants were set when about 60% of the plants were infected. All plants were pulled and burned and the field reset ten days later with healthy plants. Only one center of infection developed during the season. Other two fields were a total loss when discovered on June 12. All plants in one field were cut near ground and carried out of field. About 50% of stumps developed suckers, but these plants remained practically free from infection, and grew to good size although leaves were undersized. (W. B. Tisdale)

South Africa: Wildfire and angular spot in tobacco has been causing considerable anxiety amongst tobacco growers, and appears to be spreading rapidly. During the season 1920-21, this disease was only reported from the Government experiment stations at Rustenburg and Piet. Retief, from certain farms in the Piet Retief District, and one in the Rustenburg District. During the present season specimens have been identified from three more farms within fifty miles of Rustenburg, and also from Groot Marico and from Swaziland. (Wildfire and angular spot in tobacco. Jour. Dept. Agr. South Africa 4: 117. Feb. 1922)

(See also Pl. Dis. Bul. 6: 21, 40-41, 62-63, 97, 114, 139. 1922)

The earliest recorded appearances of wildfire in 1922 were - March 7 (Hensdale, New Hampshire), May 7 (Connecticut), May 25 (Hadley, Massachusetts), June 13 (Hemingway, South Carolina), and June (Dane County, Wisconsin).

Control measures

The following measures are recommended by P. J. Anderson (1):

> "On five successive crops of tobacco seedlings in the Experiment Station beds wildfire was reduced to an average of not over one percent by spraying or dusting the beds with a copper fungicide. The percentage of infection on the controls varied from 20 to 92. Copper lime dust, Bordeaux mixture and various commercial fungicides were all about equally effective. No definite interval between applications can be established, but they must be sufficiently frequent to keep the leaves covered at all times. Dusting is more expensive than spraying but is more rapid and more popular with the growers. Growers who used enough fungicide and applied it frequently enough were successful in keeping the beds clean."

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Angular-spot or blackfire caused by Bacterium angulatum Fromme & Murray

Angular-spot evidently is spreading to additional territory, for in 1922 it was reported from Connecticut and South Carolina, two states where it had not been definitely determined before. Prior to 1920 it had been reported only from Virginia where it was first noticed in 1917. It is now known to occur in Massachusetts, Virginia, Kentucky, South Carolina, Texas, North Carolina, Indiana and possibly Connecticut and Ohio. It is also said to be present in South Africa.

Connecticut: Seen for first time, 20 or more fields. Found so far chiefly in Housatonic Valley. Am not sure of the cause as we have not produced it by inoculation as yet. Fairly serious. (Clinton)

Virginia: The disease was not epidemic in any section although severe losses were seen in occasional fields. In all about 200 fields were examined in the counties of Henry, Pittsylvania, Charlotte, Prince Edward, Bedford and Amherst. The disease was found in 40% of these fields. The losses as a whole were slight; in fully 60% the loss did not exceed 1%. The loss for the state as a whole is estimated at 3%. Infection was more common in Charlotte County than in any other visited and least prevalent in Pittsylvania. In the Chatham section of the latter county there was practically no blackfire. This section was especially hard hit by the drought of last year, 1921, and it is thought that this is the most important factor in the general freedom from disease this year, since the dry weather did not permit infection of the seed capsules. The same conditions also operated to some extent over the state as a whole. Seed treatment and plantbed sanitation practices also played some part in the general reduction in severity of disease. There were 85 plantbeds inspected in the counties of Charlotte, Bedford and Amherst and blackfire was found in 22, or 26%. Our figures show that at least 2248 farmers used treated seed in 1922. No doubt the number was much greater since we do not have complete records. (Fromme)

Table 56. Prevalence of angular-spot of tobacco in 1922, as reported to the Plant Disease Survey by collaborators.

State	Prevalence of angular-spot
Massachusetts	Not serious, relatively few cases.
Connecticut	Not sure that it is the disease - first report July 31, New Milford, 3% loss.
Virginia	Severe losses in occasional fields.
Kentucky	Present in over half the fields.
South Carolina	Recorded for the first time in the state on June 2 at Paxville.

(See also Pl. Dis. Bul. 6: 63, 83, 96. 1922)

References:

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Black root rot caused by Thielavia basicola (B. & Br.) Zopf.

Black root rot caused unusually heavy losses this season.

Table 57. Prevalence of black root rot in the U. S. during 1922, according to Plant Disease Survey collaborators.

State	Prevalence and importance - 1922
Massachusetts	Serious in a few fields.
Connecticut	More on the earlier set tobacco.
Virginia	Caused considerable complaint.
Kentucky	15% loss in Burley section - inspected 76 fields.
Florida	Present throughout Gadsden County.
Ohio	Considerable in plant beds.
Wisconsin	More than usual,- 15% loss. Resistant strains used in some cases.

Virginia: This disease was also prevalent and the cause of considerable complaint in some sections especially in Bedford and Charlotte Counties. It is usually found in rather well defined areas in the fields and is especially apt to occur where cowpeas or soybeans have preceded tobacco. Loss about 1%. (Fromme)

Florida: Root rot was prevalent throughout the county of Gadsden this year and caused damage varying from slight or unnoticeable stunting to more than 50% loss. Heavy rains favored attack. (W. B. Tisdale)

(See also. Pl. Dis. Bul. 6: 63, 97, 113, 140. 1922)

Varietal susceptibility

Kentucky: About 300 lots of experiment station resistant strains of Stand-up Burley tested on farms. Results very promising. At least four men raised seed in quantity for sale, for 1923 crop. First year I have observed root rot causing loss in dark sections. (Valleau)

Florida: It was quite evident that plants which were attacked by root rot were also badly attacked by frogeye or specking. The Connecticut Round Tip proved to be highly resistant to root rot. (W. B. Tisdale)

"An account is given of breeding experiments with tobacco to secure strains resistant to the root rot due to Thielavia basicola, and the authors describe strains of White Burley tobacco that are recommended for planting either on new land or old land that is known to be diseased." (Abstract in E.S.R. 47. Oct. 1922 (1))

"Plantings of strains of tobacco made in 1920 and 1921 in soil infested with Thielavia basicola have shown marked resistance to root rot on the part of some of the strains, the more resistant ones yielding double the crop of the more susceptible ones." ((2) From Abstract in E.S.R. 47. Oct. 1922)

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Mosaic

Mosaic is of much importance in some areas, as in Kentucky, where counts in 76 fields showed 8% loss, while in others it comes so late that the harvest is over before it has an opportunity to cause much loss. The relative prevalence over the whole tobacco growing area of the United States seems to be about the same from one year to another.

Table 58. Prevalence and importance of mosaic in 1922.

State	Prevalence and importance
Massachusetts	In Connecticut Valley. Much more than usual.
Connecticut	Average. In Hartford, New Haven, Litchfield and Fairfield Counties.
New York	Present.
Virginia	1-50% around Lynchburg. 1% loss.
Kentucky	Counts in 76 fields, 8% loss.
Florida	In only a few fields before harvest.
Ohio	Less prevalent, only of moderate importance.
Wisconsin	Secondary rusting caused most concern.
Quebec, Canada	Present.

Virginia: Mosaic was more prevalent than in previous years. It was found in 50% of fields and up to 50% of plants in these fields were affected. Mosaic losses are not so great on the types of tobacco grown here as on the finer leaf or wrapper tobacco. The farmer usually does not consider it a disease of importance, and attributes it to rainfall, fertilizer, topping, suckering and various other things. It is usually more prevalent on the tobacco plants that have been reset than on those of the first planting. It is frequently found on 100% of the suckers which are allowed to grow after the crop has been harvested. Loss for the state, 1%. (Fromme)

Kentucky: The relationship between mosaic of bull nettle, ground cherries (3 sp.) tomato and tobacco, has been proved the past summer by cross inoculations. It may be transferred readily from one plant to another. Inoculations from pokeweed, bean, soybean and clover to tobacco failed to produce mosaic. White fly has been found not to be a carrier of the mosaic of tobacco under greenhouse and field conditions.

It was observed that in sections where there is much available space for seed beds such as in the hilly sections of the state, tobacco mosaic is often difficult to find,

whereas in the blue grass section where beds are usually planted near where tobacco has previously been grown it is very prevalent. A permanent tobacco bed steamed each year and in which perennial solanaceous weeds were nearly eradicated produced nearly a disease-free crop, but a burned bed used three years and with numerous solanaceous plants produced crop with initial infection of 9%. The disease does not seem to be carried into beds even from plants just outside of bed. A spray of oil on weeds, Physalis and bull nettle, in late August killed tops but most of them send out new shoots before late fall. Root stalks apparently not injured. (Valleau)

Florida: Mosaic appeared in only a few fields before the plants were topped and harvest begun. All suckers in practically every field become badly infected. It has occurred to me that this late infection might be due to the insects coming in after the growers quit dusting the plants. None of the growers consider the disease as serious. (W. B. Tisdale)

(See also Pl. Dis. Bul. 6: 63, 96, 114, 140. 1922)

James Johnson has made the following statement with regard to the results of experiments conducted by him, indicating the nature of the mosaic virus (1):

> "Chambers in which plants can be grown under controlled temperature and humidity conditions have been constructed. It has been found that the optimal temperature for the mosaic disease of tobacco lies close to 28-30°C. The maximal temperature for its expression is approximately 37°C., that is, at this temperature inoculated plants fail to develop symptoms, and leaves showing mosaic symptoms gradually 'recover'. Similar results may follow from low temperature exposure. Quantitative determinations of enzymes, said to cause mosaic, indicate that enzymes are not correspondingly reduced by exposure of plants to the higher or lower temperatures; in fact, it is probable that the optimal temperature for their activity lies close to 37°C. It seems, therefore, that these results furnish evidence against the enzymatic theory of mosaic while at same time they favor the parasitic hypothesis, since the temperature curve for the development of mosaic corresponds closely with that of the development of many of the plant pathogens."

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Other diseases

Bacterial wilt caused by Bacterium solanacearum EFS was present in one 16-acre field in Gadsden County, Florida, reducing the yield about 10% (Tisdale), but in Virginia where it is usually present, it was not seen this season.

Leaf spot or frogeye caused by Cercospora nicotianae E. & E. became prevalent and in a few cases serious in Gadsden County, Florida, immediately following a rainy period. The disease was most serious in shades which were infested with Thielavia basicola, and the growth of the plants was checked by this fungus. The disease first appeared on the lowest leaves and advanced rapidly to those higher on the stem (W. B. Tisdale). Leaf spot was found also in South Carolina.

In Wisconsin there was an occasional occurrence of the Wisconsin leaf spot caused by an undescribed bacterium. The damage was negligible.

The following non-parasitic diseases have been reported:

Leaf spots - Wisconsin - Did not cause much concern.

Rust - Massachusetts and Connecticut - Fairly common.

Pole sweat - Massachusetts - Wet weather after harvest favored trouble, unusually serious.

Broad leaf spot - Massachusetts - Prevalent in most broad leaf fields.

Sand drown - (See Garner, W. W., J. E. McMurtrey, and E. G. Moss. Sand drown, a chlorosis of tobacco due to magnesium deficiency and the relation of sulphates and chloride of potassium to the disease. Jour. Agr. Res. 23: 27-40. Jan. 6, 1923; same authors, Science n.s. 56: 341-342. Sept. 22, 1922.)

Magnesium hunger - Connecticut - Not common.

Wind injury - Connecticut - in scattered fields.

Water injury- Connecticut - Excessive rains drowned tobacco in low fields.

Ring spot or hieroglyphics - Virginia, Kentucky, Ohio - Attempts at cross inoculations were made by Valleau in Kentucky. Inoculations were made by rubbing diseased plants with fingers, then rubbing healthy ones. Two infections were obtained out of about 200 attempts. The checks remained healthy. The disease caused considerable alarm among farmers in Virginia. It was there second in importance to black fire, causing about 2% loss for the state. It had been watched for several years and had not been considered of serious importance previously. (Fromme)

The following diseases, the cause of which has been at least partly determined, were reported:

Fusarium sp. in plant beds - Ohio (See Plant Disease Survey Bul. 6: 114. 1922).

Shoe string or frenching, often considered a type of mosaic, caused severe loss in one field in Virginia.

Leaf spot caused by Phyllosticta spp. was rather common in Virginia on seedlings in plant beds, especially those beds showing lack of fertility. It does not seem to persist in the field. (Fromme)

White speck attributed by R. C. Thomas to Macrosporium tabacinum E. & E. is present in Ohio, particularly in Brown County where there is a small heavily infested area. Clinton reports white speck from Connecticut and suggests that the cause may be physiological.

Brown spot caused by Alternaria sp. was also observed in Ohio.

Other common diseases were damping-off caused by Pythium debaryanum Hesse, and found to a very limited extent in Connecticut and Wisconsin; and root knot caused by Heterodera radicicola (Greef.) Müll. This latter disease resulted in 1% loss in South Carolina, and did considerable injury in some fields of Gadsden County, Florida. A root knot was also found at Alexandria, Kentucky, but no nematodes could be found associated with the swellings of the roots.

References

Garner, W. W. Tobacco culture. U. S. Dept. Agr. Farm. Bul. 571: 1-24. Rev. Oct. 1922. (Dec.)

Scherffius, W. H. The future of the tobacco industry in South Africa. Jour. Dept. Agr. Union South Africa 4: 224-227. 1922.

DISEASES OF MISCELLANEOUS VEGETABLE CROPS

ARTICHOKE

Botrytis rot on globe artichoke: "Although primarily a transit disease it begins in the field where the original contamination and frequently the original infection takes place. The fungus was found in the artichoke fields near Half Moon Bay, California. There, favored by heavy fogs and cool weather, the fungus grows and sporulates profusely. Lesions on the growing buds generally are to be ignored in harvesting and packing.

"The fungus causes very little rot at temperatures above 80°F., and practically none at 0 to 2°C., although it grows slightly on agar at 0°C. The rot progresses most rapidly at temperatures between 68 and 75°F., lesions 4-8 mm. in diameter developing within 24 hours after inoculation." (Link, Geo. K. K., G. B. Ramsey and Alice A. Bailey. (Abstract) Phytopath. 13: 58. Jan. 1923)

ASPARAGUS

Rust caused by Puccinia asparagi DC.

Asparagus rust is distributed over almost the entire United States, reports having been received during past years from every state but Florida,

Utah, Nevada, Wyoming, Idaho and Montana. The losses incurred have been so much reduced since resistant varieties were introduced, that the disease is no longer an economic factor in many localities.

Table 59. Prevalence and importance of asparagus rust in 1922.

State	Prevalence Compared with: Last Year	Prevalence Compared with: Average Year	Remarks
Massachusetts		Same	Most serious in eastern part of state.
New York		Same	Present on susceptible varieties.
New Jersey			Severe in some fields in Cumberland Co.
Delaware		More	Very prevalent on Palmetto, - Bordeaux gave good results.
Texas			Trace.
Ohio	Same	Same	Destructive on susceptible varieties.
Indiana	More	More	Destructive locally.
Illinois	More	More	Appeared late,- trace of loss.
Minnesota	Same	Same	Not abundant.
Iowa		Same	Local,- 8% loss.
North Dakota	Less	Less	Not as prominent as in other years.
Missouri		Same	Present
Colorado			Present

Table 60. Dates of earliest appearance of asparagus rust in 1922.

Date	Place	Date	Place
May 28	Chisago Co., Minnesota	August 28	Vigo Co., Indiana
June	Monroe, New York	August	Wayne Co., Ohio
July 1	Wayne Co., Illinois	August	Fort Collins, Colorado
July 12	Cannon, Delaware		

A stem spot caused by Cercospora asparagi Sacc. was found on young seedling plants in Delaware. (Adams)

"Fusarium rot of asparagus shoots, presumably the same as that reported by Cook. (Mel. T. Cook. A new disease of asparagus. (Abstract) Phytopath. 12: 49. Jan. 1922) was received by the Office of Cotton, Truck and Forage Crop Disease Investigations from the following points in 1922: May 4, North Tarrytown, New York; and June 10, Hollisterville, Pennsylvania." (W. W. Gilbert)

A twig canker (cause undetermined) was collected in South Carolina. (Ludwig)

BEET (Garden)

Scab caused by Actinomyces scabies (Thax.) Güssow was reported from Massachusetts, New York, New Jersey, Ohio, Minnesota, North Dakota and Idaho. The reduction in market value was no more than a trace.

Leaf spot caused by Cercospora beticola Sacc. was reported from Vermont, Massachusetts, Connecticut, New York, New Jersey, Delaware, Florida, Louisiana, Texas, Chio, Indiana, Illinois, Minnesota, North Dakota, and Colorado; and probably was present in other states. In most cases only slight injury resulted but in Marion and Lake Counties, Indiana, Gardner found severe infections; in New York, M. C. Hammond reported that there was considerable damage to plantings in the Warwick section of Orange County; in Larimer and Weld Counties, Colorado, it caused a death of the leaves which placed the crown higher when the new leaves came on about a month later (Learn); and in New Jersey the leaf spot was destructive both on garden and mangel beets. There was 100% of infection of the latter in a low wet area in Atlantic County. The leaves turned yellow and dropped. The part of the root above ground was also attacked.

Root knot caused by Heterodera radicicola (Greef) Mull. was the cause of 2% loss in Texas. (Taubenhaus)

A root disease caused by Rhizoctonia sp. was observed in Weld and Larimer Counties, Colorado. (Learn)

In Louisiana, wilt caused by Sclerotium rolfsii Sacc. affected patches of beets that went into the warm spring weather, the loss being as high as 50%. (Edgerton)

CARROT

Soft rot caused by Bacillus carotovorus Jones was present in Massachusetts, New York, New Jersey, and Colorado. E. E. Clayton of Long Island suggested that it was largely secondary to other troubles, especially leaf blight. In New Jersey it was pointed out that carrots are seldom attacked in the growing stage, but only after they are mature and left in the soil. Therefore, harvest should be made as early as storage conditions will permit.

Watery soft rot caused by Sclerotinia libertiana Fckl. resulted in slight injury in New Jersey and Louisiana. The rot was more common on densely crowded young plants, and in storage pits.

Leaf blight caused by Macrosporium carotae E. & L. was common in Massachusetts, New York, New Jersey, and Kansas. On Long Island the great loss consisted in making it impossible to sell carrots in bunches. (Clayton)

Black rot caused by Alternaria radicina Meier, Drechsler& Eddy has been described as a new storage rot of carrots. It was found in material from various points in New York, Massachusetts, and Pennsylvania and in Washington, D. C. It is thought that the disease is probably generally distributed throughout the carrot storage area of the eastern part of the country. (Meier, F. C., Charles Drechsler, and E. D. Eddy. Black rot of carrots caused by Alternaria radicina n. sp. Phytopath. 12: 157-166. Apr. 1922)

Leaf spot caused by Cercospora apii carotae Pass. was serious in market gardens in Indiana. (Gardner)

Nematodes were found in carrots in Washington.

The Rio Grande Valley disease (cause unknown, and which had previously been reported in lettuce), was recorded in Texas on carrot.

CELERY

Late blight caused by Septoria apii (Br. & Cav.) Chester

Late blight was much more destructive than usual in the eastern celery sections. This was evidently due to the heavy rainfalls. The infection was so abundant that many men who applied fungicides did not get satisfactory results in control. Evidently the first applications were not made until the disease began to show.

Table 61. Importance of late blight of celery in 1922, according to collaborators.

State	Remarks
Vermont	25% crop affected, loss slight.
Massachusetts	Much more - very severe - general.
Connecticut	Same amount as usual.
New York	5-10% loss, more than usual.
New Jersey	15% loss. Heavy loss in low wet areas.
Pennsylvania	15-40% reported - worse than usual.
Delaware	Same as usual. Bordeaux gave good control.
Ohio	Less than usual - severe in some fields.
Illinois	Trace. Abundant where Skinner irrigation system is used.
Michigan	Extremely severe in all regions.
Minnesota	Same as usual,- not of much importance.
Colorado	Unimportant.

New Jersey: A good many growers used anhydrous copper dust treatment this year, most of whom considered it worthless. (R. F. Poole)

New York: Careful spraying or dusting gave almost complete control. (Charles Chupp)

Septoria blight of celery has occurred only occasionally in the past five years that I have been associated with the celery situation in Western New York. Many fields this year are suffering severely with this blight. Septoria blight is general and destructive in many fields. (H. W. Dye)

On September 27 I examined the plantings of celery on the College farm which included fifty-four named varieties and about one hundred strains, considering a strain as a separate seed source. The late blight fungus was noted by the professor in charge of the variety test the week of September 4. At the time I visited the plots all the varieties and strains were badly infected. I could see no certain indication of resistance in any variety or strain, although Easy Blanching and one or two of the Rose varieties (Farquhar's Giant Red, also Meisch's Own Grown Green celery) appeared to be slightly less affected. No detailed counts were made on any of these. (H. E. Thomas)

(See also Pl. Dis. Bul. 6: 148-152. 1922)

Table 62. Dates of earliest appearance of late blight of celery in 1922.

Date	Place	Date	Place
July	Orange County, New York	September	Denver, Colorado
July 7	Ramsey County, Minnesota	September	Dover, Delaware
July 15	Bergen County, New Jersey	September 20	Ashland County, Ohio
August 22	Milford, Connecticut	September 25	Vermont

Early blight caused by Cercospora apii Fr.

Early blight was observed in Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, South Carolina, Florida, Ohio, and Indiana. It was not reported from Vermont or Michigan. The disease was distributed very unevenly in the different celery districts. In New York the late blight was the prevailing fungous disease, yet occasional isolated fields were injured severely by the Cercospora. In New Jersey early blight was found principally in the upland celery; in North Carolina it was important only locally; in Massachusetts and Delaware it was general but not destructive; and in Connecticut, Pennsylvania, Florida, Ohio and Indiana it was unusually destructive. The first infections were found July 15 in Bergen County, New Jersey, and at Calhoun, South Carolina. Other dates were August 1, Sanford, Florida; August 26, Stratford, Connecticut; September 4, Wilmington, Delaware; and September 15, Medina County, Ohio.

According to Jagger (Florida) losses from blight can largely be attributed to the carelessness in spraying. A. C. Foster (Florida) writes, "Controlled very effectively by constant spraying with liquid Bordeaux, 4-4-50, at the rate of 100 gallons to an acre every 7 to 10 days." R. F. Poole (New Jersey) verified this statement. "Splendid control has been produced with Bordeaux mixture." (See also Pl. Dis. Bul. 6: 148, 152-153. 1922)

Yellows caused by Fusarium sp.

Yellows seems to be increasing in its prevalence and geographic range, having been reported from New York, Pennsylvania, Indiana, Ohio, and Michigan. In Niagara County, New York, one man lost 100,000 plants because of this disease (Specimens were sent to Michigan for identification.). In Ohio it is gradually increasing, although it is not yet of sufficient importance to occasion serious concern (R. C. Thomas). In Pennsylvania, Beach found the disease in two localities causing 5% and 25% losses, respectively, on Golden Self Blanching celery. Coons and Nelson are still testing strains resistant to yellows. (Phytopath. 13: 56. 1923): "Seed production of Golden Self-Blanching Celery resistant to yellows (Fusarium sp.) was continued on a small scale in 1921 and about a pound of resistant seed is now available for increase. Testing concerned itself with comparing progenies of individual plants for disease resistance. The second generation plants from most isolations possess the same tolerance as the parents and have developed well in infested soil in which commercial seed has failed completely." (See also

Pl. Dis. Bul. Suppl. 22: 403-404. 1922.)

Bacterial leaf spot caused by Bacterium apii Jagger

Bacterial leaf spot was found in New York, Michigan and Ramsey County, Minnesota. This is the first report from Minnesota. It was prevalent in its usual amount in both New York (2-5% loss) and Michigan. Either spraying with Bordeaux mixture or dusting with copper-lime dust gave excellent control under New York conditions.

Black heart

Black heart (apparently physiological) is reported from Florida as follows:

> "I am quite certain that the so-called black heart they have in New Jersey and Pennsylvania is distinctly different from that found here. The black heart found in the East is a typical soft rot and decay evidently caused by Bacillus carotovorus or closely related forms, and the disease as found in Florida is non-parasitic, with decidedly different symptoms." (A. C. Foster)

> "Apparently a physiological browning and death of the edges of the leaves of the heart, brought about by too hot weather. Decay organisms usually gain entrance through the physiological lesions. Usually there is little or no trouble with heart rot until the weather changes from the comparatively cool weather of the winter to the warmer weather of the spring months, which usually occurs in March. There is always some loss from heart rot in the later celery." (Ivan C. Jagger)

Other diseases

Soft rot caused by Bacillus carotovorus Jones, resulted in heavy losses in Massachusetts and Pennsylvania, and slighter ones in New Jersey and Florida. R. F. Poole (New Jersey) stated that the Golden Self-blanching variety was the most susceptible but that the green varieties were also attacked. In Pennsylvania C. R. Orton also noticed that the easy Blanching varieties were the more susceptible.

Heart rot caused by bacteria was observed occasionally in Louisiana and did much damage in Delaware, according to collaborators.

Watery soft rot caused by Sclerotinia libertiana Fckl. was reported from Massachusetts, New York, New Jersey, Florida and Ohio. R. F. Poole (New Jersey) says: "This disease is known as foot rot in some fields, where it causes slight damage, especially to plants undergoing blanching with boards. It is very serious in some greenhouses, causing the loss of many seedling plants at a time when they are needed for resetting in the field." References: Poole, R. F. The Sclerotinia rot of celery. New Jersey Agr. Exp. Sta. Bul. 359: 5-27. 1922. Some recent investigations on the control of Sclerotinia libertiana in the

greenhouse on the muck farms of Bergen County, New Jersey. Phytopath. 12: 16-20. Jan. 1922.

Root rot caused by Phoma apiicola Speg. is described from Michigan by C. W. Bennett in "A Phoma root rot of celery." (Michigan Agr. Exp. Sta. Tech. Bul. 53: 1-40. 1922.) The disease was not seen in Michigan during 1922.

Root rot and stem browning caused by Rhizoctonia sp. were noted in New York and Ohio.

Damping-off caused by various organisms, such as Pythium, Phytophthora, and possibly Sclerotinia was reported from Florida.

Mosaic was observed on the College Farm in New Jersey on several varieties, including both yellow and green celery. Nothing is known regarding its origin and relation to other hosts. The disease was transmitted by means of aphids from diseased to healthy plants. The disease was observed last year in New Jersey for the first time (R. F. Poole). It was also reported from Indiana and Minnesota. The disease has not yet attained any marked economic importance. Reference: Poole, R. F. Celery mosaic. Phytopath. 12: 151-154. Mar. 1922.

Plants covered with a slime mold, Physarum gyrosum, were collected in Orange County, New York. The determinations were made by Dr. Frank Wann.

Root knot caused by Heterodera radicicola (Greef) Müll. was noted in shaded and wet areas in greenhouse beds and in low, wet fields in New Jersey. Infection was more pronounced on Golden Self-blanching than on the green varieties. (Poole) In Florida nematodes were unusually prevalent on celery. (See root knot on lettuce - note by Foster)

Bunched red roots (physiological ?) was once called to the attention of G. P. Clinton in Connecticut.

Frost injury is reported by C. L. Brown (Bur. Mark. & Crop. Est. Div. Letter 7: 31. Feb. 2, 1922), from California as follows:

> "Shippers tell me that northern celery (Sacramento Section) is severely injured, and not very many future shipments will come from there. Damage around here (Los Angeles) is estimated by some at 50%, but that is only guess work. All we know for sure is that there has been considerable damage."

General reference

Whetzel, H. H. Celery diseases. Agr. Bul. Bermuda Dept. Agr. 2: 7-8. 1923.

CHICORY

Root knot caused by nematodes was reported from Barnstable County, Massachusetts. It was the only authentic report of nematodes on outdoor crops in this state. (Osmun)

EGG PLANT

Leaf spot and fruit rot caused by Phomopsis vexans (Sacc. & Syd.) Harter was recorded as follows: New York (reported only once, but common in

Schenectady, Monroe and Erie Counties); New Jersey (generally distributed, some well sprayed fields almost free from rot; one unsprayed field had approximately 80% diseased fruit); Maryland (5% loss, same as usual); Florida (quite prevalent and doing much damage); Ohio (one report); Illinois (2% loss, less serious than last year); Wisconsin (trace - crop of minor importance); and Iowa (trace).

According to Edgerton and Moreland (Louisiana Agr. Exp. Sta. Bul. 178. 44 p., 1921), "The egg plant blight (Phomopsis vexans) reduces the yield in Louisiana 50-75%.....Spraying is successful only when the plants are kept covered with the fungicide, which requires 10 to 12 sprayings in Louisiana. Control measures advocated include clean seed, rotation, strong plants for transplanting to the field, and the use of the most resistant varieties."

Wilt caused by Verticillium albo-atrumReink. & Berth. was present in New York (especially Schenectady County), Indiana (serious in market gardens), Pennsylvania, and New Jersey (more than usual, in all sections but more prevalent in southern part of state).

Leaf spot caused by Macrosporium solani E. & M. was reported by Clinton from Connecticut.

Phytophthora terrestria Sherb. caused rot of immature fruit and premature dropping of fruit in the experimental gardens in Indiana. Kendrick (See Proc. Ind. Acad. Sci. 1922) shows that the organism is the same as that causing buckeye rot of tomato.

Mosaic - Connecticut. (G. P. Clinton)

An undetermined disease caused almost a complete failure of egg plants in Kentucky. Spraying with Bordeaux mixture helped. (J. S. Gardner)

Damping-off caused by Rhizoctonia sp. was observed in Florida. No great loss was sustained.

General references

Ishikawa, Takitaro & Isamu Shiozaki. Sekkwai iwo gozai dojo shodoku to nasu (Soil disinfection with lime sulphur and its effect on the egg-plant). Byochuggai Zasshi (Jour. Plant Prot.) 9: 29-34. January 1922.

Welles, C. G. and E. F. Roldan. Solanaceous wilt in the Philippine Islands. Philipp. Agr. 10: 393-398. Mar. 1922.

_____ Cercospora leaf spot of eggplant. Phytopath. 12: 61-65. Feb. 1922.

ENDIVE

Watery soft rot caused by Sclerotinia libertiana Fckl. resulted in heavy losses (15-20%) in trucking districts around New Orleans, Louisiana. The decay began on the lower leaves, and finally involved the whole plant.

Heart rot (cause undetermined) caused a rot of tender soft leaves of endive in New Jersey. The loss was slight.

ESCAROLE

Watery soft rot caused by Sclerotinia libertiana Fckl. injured 35 to 50% of the crop in Louisiana, and caused a loss of 2 to 5%.
Mosaic caused slight loss in Louisiana.

GINSENG

Corroded roots from which Ramularia was isolated repeatedly were reported from Washington by Dana.

LETTUCE

Drop caused by Sclerotinia libertiana Fckl.

Drop is a very serious disease of lettuce particularly under glass. It may also cause much loss on muck farms, although in the latter case the Rhizoctonia bottom rot is often mistaken for it. It is probably present in all the commercial lettuce areas. In 1922 it was more or less serious in Massachusetts (most serious disease of lettuce), New York (1-2% loss, confined mostly to greenhouses), New Jersey (0.75% loss on muck farms), Delaware (important locally), Pennsylvania (5-30% in sash and field in Philadelphia district), South Carolina (trace), Florida (important in storage), Louisiana (5% loss), Ohio (a greenhouse trouble), Indiana (serious in greenhouses), Minnesota (2.7% loss), Kansas (Considerable in greenhouses), and Washington. Higher temperatures evidently tend to reduce the amoung of drop. Dr. I. C. Jagger made the following comments in a letter (Jan. 10, 1922):

> "The early fall lettuce, which is harvested before December 1, is invariably little injured by Sclerotinia, but after December 1, Sclerotinia becomes increasingly destructive, and is always a serious trouble on lettuce harvested during the last half of December and during January and February."

References

Beach, W. S. The lettuce drop due to Sclerotinia minor. Pennsylvania Agr. Exp. Sta. Bul. 165. 1921.

Botany and Plant Pathology. Pennsylvania Agr. Exp. Sta. Bul. 170: 15-20. 1922. Continued observation of S. libertiana show that the fungus will die in the soil in two years if no susceptible crop is grown.

Soursac, Louis. La pourriture du collet de la laitue et de la chicorée. Rev. Bot. Appl. 2: 562-567. Oct. 1922.

Bottom rot caused by Rhizoctonia solani Kühn

Bottom rot was reported from Massachusetts, New York, Pennsylvania, and Kansas. In New York this is by far the most serious field disease, the average loss being estimated at 10 to 15%. Occasionally the entire crop of a field is wiped out. In Massachusetts the disease seemed to be most important under glass. In Pennsylvania there was a 40% loss of Big Boston in the Philadelphia section. In the greenhouses of Ohio a root infection occurred, resulting in rosetted plants. In New York breeding for disease-escaping strains is still continued.

Tipburn (non-parasitic)

Tipburn was the second most serious disease of field lettuce in New York State. The loss was estimated by A. G. Newhall as being 5 to 10%. It was worse on Big Boston than on Romaine. There was about 3% loss on the Los Angeles Market variety. It was also reported from Colorado, South Carolina, Texas and Idaho, but was not deemed of economic importance in these states, except in Texas where Taubenhaus is making a study of the disease.

Bacterial diseases of lettuce

Bacterial rosette caused by Aplanobacter rhizoctonia Thomas was found in Ohio chiefly in greenhouses although discovered on head lettuce grown in the field and causing 5 to 10% loss. Lettuce rot caused by Bacterium viridilividum Brown (?) and dwarfing caused by Bacterium vitians Brown (?) were both observed in New York. Bacterium marginale Brown was reported from Kansas. A bacterial leaf spot (cause undetermined) was observed on lettuce in Florida. In Oregon an internal leaf rot (bacterial (?)) caused 2% loss at Multnomah. It was general in Klamath and present in the Malheur irrigated districts. In Mississippi a bacterial (?) spot possibly following excessive use of nitrogenous fertilizer and in Arizona, following frost injury were mentioned. In the latter state one field of 110 acres, in addition to several smaller ones, was practically a total loss.

Reference

Thomas, R. C. A bacterial rosette disease of lettuce. Ohio Agr. Exp. Sta. Bul. 359: 197-214. 1922.

Gray mold rot caused by Botrytis cinerea Pers.

Gray mold rot was unusually prevalent in St. Louis County, Minnesota, causing 10% reduction in yield. In New Jersey during the rainy weather it also caused a great depreciation in marketable value of the crop by rotting the top and bottom leaves of field grown lettuce. In Massachusetts, New York, Ohio, Iowa and Kansas, it did considerable damage under greenhouse conditions.

Downy mildew caused by Bremia lactucae Regel.

Downy mildew is usually of economic importance only in poorly ventilated greenhouses and hot beds, although occasionally it may become serious under field conditions. In 1922 it was reported from Massachusetts, New York, New Jersey, South Carolina, Ohio, Indiana, Minnesota, Iowa, Colorado and California. In nearly all cases it was a minor disease. In New York, New Jersey and Minnesota where it occurred in the field the date of earliest appearance was late June and July, when the temperature was below normal. In New York the second crop which is harvested in the fall ordinarily is attacked. This year it was the first crop that was affected. Incidentally July temperature was subnormal (-0.5°F.) and September temperature above normal (+1.9°F.). In addition, the percentage of fair weather in July was between 40 and 50%, while in September it was between 50 and 60% (See Monthly Weather Review 50, Nos. 7 and 8. 1922). Of course, this information alone is too meagre from which to draw conclusions, but it coincides with the data obtained by A. T. Erwin (Controlling downy mildew of lettuce. Iowa Agr. Exp. Sta. Bul. 196: 1921) who found that downy mildew was most severe when the percentage of sunshine was below 55, and the temperature below 55°F.

Following are reports from collaborators concerning downy mildew:

Massachusetts: Not ordinarily serious: Usually associated with faulty ventilation. (Osmun)

New York: Slightly more on first crop. Usually there is more on the second crop. A few growers tried the variety Los Angeles Market, but it mildewed badly. (Newhall)

South Carolina: Crop could not have been shipped but large part of loss was obviated by selling locally. (Ludwig)

California: Very general in all fields in state. Loss on 8000 acres about 4%. (Milbrath)

Other diseases

Rio Grande disease (cause unknown) caused .5% loss in Texas according to Taubenhaus, who says:

> "This disease attacks the lettuce in which it frequently causes serious damage. The disease was found on two new hosts, the carrot and a weed known as Borage, a plant which the Mexicans use for food for burros."

Leaf spot caused by Alternaria sp. is reported by A. C. Foster from Florida as follows:

> "In several instances I have found typical Alternaria leaf spots on lettuce, the characteristic concentric rings and spores being present. I do not know whether this has been reported on lettuce before."

Root knot caused by Heterodera radicicola (Greef) Müll. was found mainly in hot houses in Ohio. It was controlled by steam sterilization. Foster of Sanford, Florida, gave the following information:

> "The infestation of nematodes rather generally throughout the section on all of the different crops has probably caused as much concern as any one disease. Both lettuce and celery seedlings were heavily affected in the seed beds, to such an extent that in some cases the grower sustained a total loss of his plants. The disease is now very common in the field, especially on celery, and will no doubt cause heavy losses. As a rule the growers in this section do not take any precautionary measures to prevent losses from nematodes either in the seed beds or in the field, but there are a few instances where a more progressive grower has tried the formaldehyde treatment of his seed bed or the cyanamide treatment of sections of his field. Results obtained so far have not been encouraging."

Anthracnose caused by Marssonia panattoniana (Berlese) Magnus was rarely found in New York, Florida and Washington.

Mosaic, according to A. G. Newhall, is the third most serious disease of lettuce in New York. The virus is carried by potato aphids and in the seed. One to three percent of the young seedlings are affected. The loss in 1922 was 2-3%. In the average year the loss has been 5-6%. It was also reported from Florida (fairly important), Minnesota (first report), and Connecticut (two reports on Cos lettuce).

Dwarfing caused by Pythium sp. is present, both in the field and under glass in New York State. The loss is merely a trace.

Damping-off in Florida is reported by Foster as follows:

> "Many of the growers have experienced rather heavy losses of seedlings because of damping off, that is probably caused by several different organisms, possibly Pythium, Phytophthora, and in a few instances possibly Sclerotinia."

Southern blight caused by Sclerotium rolfsii Sacc. was of little importance in Florida, according to Foster.

Leaf spot caused by Septoria consimilis E. & M. or Septoria lactucae Pass. was reported from New York (Present first time in several years. In few fields severe; affects only outer leaves. One man had entire loss of crop. Loss for state, t-2%), New Jersey (Slight. This disease was quite severe in one field of lettuce. The loss amounted to about 50%. The plants rotted or were worthless after becoming diseased.), Indiana (Serious locally), Illinois (trace), Minnesota (First report in the State), and Missouri (One report).

White heart or rabbit ear was rare in New York State this season. A. G. Newhall is of the opinion that the disease is either produced by aphids, or the causal agent is disseminated by them.

Foot rot (formerly called heart rot; cause unknown) was serious in the Imperial Valley, California. The loss was 5% in 8000 acres. (Milbrath)

A stunting in young stages of the early crop was noticed in Kentucky. No cause was assigned.

Frost injury was very important in the Los Angeles section of California, according to C. L. Brown, Bur. Mark. & Crop Est. Fruit & Veg. Div. Letter 3: 45. Feb. 16, 1922, who says:

(Feb. 6) "The frosts have cleaned up the lettuce in the Los Angeles section to the extent that there is scarcely enough lettuce for the local market, and this is of very poor quality. Imperial Valley lettuce was undoubtedly injured to quite an extent."

Stunting resulting from an excess of soluble salts in the surface soil (reason given by S. D. Conners, who has made a study of this type of trouble) occurred in patches in many greenhouses. The trouble was controlled by leaching and better under-drainage. (M. W. Gardner)

MANGEL

Damping off caused by Sclerotinia libertiana Fckl. developed rather abnormally in one field on Long Island.

Rhizoctonia sp. was observed in Washington by Dana. He also reported a leaf blight, the cause of which was not determined.

OKRA

Wilt caused by Fusarium vasinfectum Atk. was observed in Louisiana and Texas. The injury was slight in each case.

Wilt caused by Verticillium albo-atrum Reink. & Berth. was found in Burlington County, New Jersey.

Texas root rot caused by Ozonium omnivorum Shear reduced the yield in Texas 10%, according to Taubenhaus.

Root knot caused by Heterodera radicicola (Greef) Müll. was serious in some limited sections of Louisiana, according to Edgerton, and caused 1% loss in Texas. (Taubenhaus)

PARSLEY

Bacterial wilt caused by Bacillus nelliae Welles is reported from the Philippines. Reference: Welles, C. G. Identification of bacteria pathogenic to plants previously reported from the Philippine Islands. Philipp. Jour. Sci. 20: 279-285. Mar. 1922.

Leaf spot attributed to Cercospora apii Fr. or Cercosporella pastinaceae Karst. was reported from New York (serious), Connecticut (bad in one place), West Virginia (abundant in one garden), Indiana (serious locally), and Minnesota (a trace). There seems to be a want of agreement among the collaborators as to the exact fungus causing the injury. This point should be cleared during the coming summer.

Blight caused by Mycosphaerella pinodes Berk. & Blox.

Ascochyta blight was found in New York, Delaware, South Carolina, Wisconsin and California. Milbrath reported that the disease was very severe in Carlsbad, Pismo, Hayward and Ignacio regions, California. There was 15% loss on 4,000 acres. Reports in the Plant Disease Survey files indicate that the disease has been found previously in 26 states. No doubt it occurs elsewhere, and collaborators from the states which are not marked on the accompanying map should report if it has been collected, so that the distribution could be given more accurately.

Powdery mildew caused by Erysiphe polygoni DC.

Powdery mildew coming late on an early harvested crop is usually not an important disease, but there are certain exceptions as are indicated by the following comments:

Florida: Mildew was reported from one section of the state and was said to be the cause of many failures in pea growing. (Burger)

Mississippi: Reported from several localities throughout the state causing rapid defoliation of vines and reduced yield. Common in many gardens in this vicinity and in Starkville. (Neal)

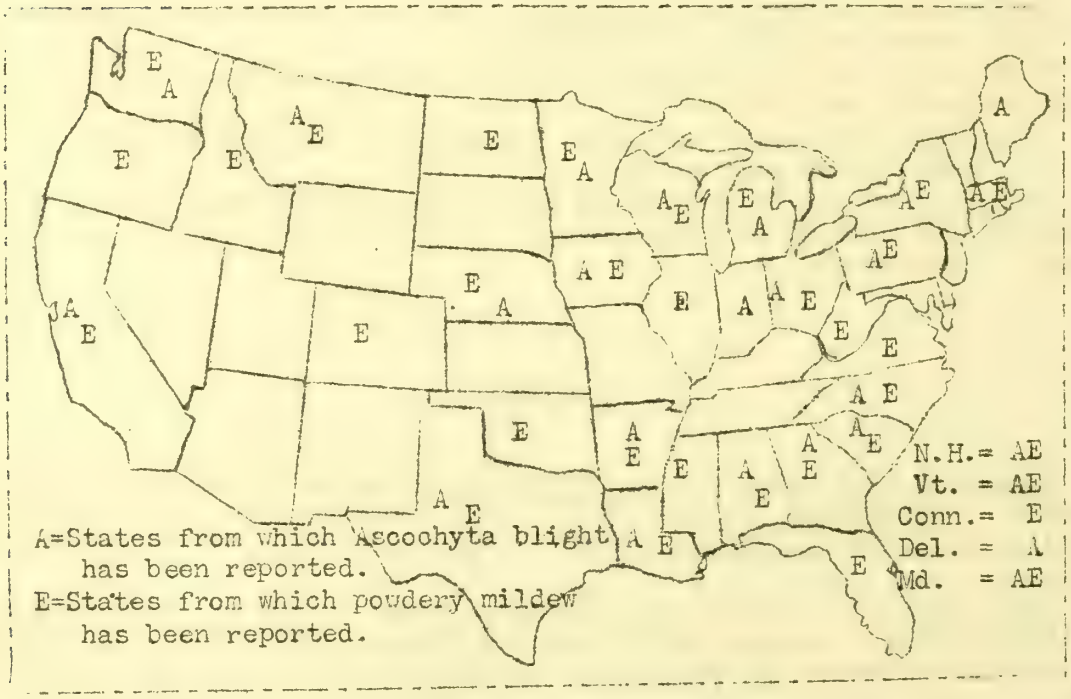

Fig. 13. Distribution of Ascochyta blight and powdery mildew of peas. Data obtained from all Plant Disease Survey reports, including those of 1922. (Collaborators should check this list of states and make any additional reports they may have.)

Illinois: Destructive especially on late maturing varieties. (Gardner)

Oregon: Two or three reports from Clatsop County where the whole section around Brownsmead is reported by the county agent to be affected especially in places protected from the wind. (Barss)

California: Reported on canning crop but not starting early enough to be destructive on winter crop in central California this year. (Horne)

In addition, the disease was reported from Ohio, Wisconsin, and Colorado. In the past it has been reported from 34 states, but like Ascochyta blight, is probably present wherever peas are grown.

Root rot caused by Fusarium sp.

Fusarium root rot was mentioned only in Massachusetts (more serious than usual); New York (2-3% loss); Delaware (important locally); Ohio (serious); and Indiana (50% loss on one farm). But judging from previous records it is much more widespread. Different species of Fusarium have been named in connection with the root rot, but no detailed studies have been made. It would be very desirable to have more accurate knowledge regarding the different species which may cause pea root rot, and the distribution of each of these species.

Varietal susceptibility

According to Temple, very promising results have been obtained in their work on root rot resistance in Maryland. The following quotation is taken from a letter from Prof. Temple, June 12, 1922:

> "Our pea work with respect to resistance to the root rot has given better results this year than heretofore. The commercial stock produced a full crop on the worst infected soil that we could find. These results were very conspicuous this year, and very promising."

Other fungi which were associated with pea root rot were Thielavia basicola (B. & Br.) Zopf. (Connecticut), Pythium debaryanum Hesse (?), Connecticut, Delaware, Wisconsin, Montana), Rhizoctonia sp. (Delaware, Wisconsin), and undetermined root rots were reported from New Jersey, Maryland, Wisconsin, and Minnesota.

Delaware: Rhizoctonia sp., Pythium sp., Fusarium sp. Yield reduced 20%. Drouth and aphis attack appeared to retard growth and favor severe prevalence of the root rot. (Adams)

New Jersey: Root rot, undetermined. Yield reduced 20% for the state. Severe in southern counties. Several reports from Sussex County northern portion. (C. M. Haenseler)

Wisconsin: Pythium, Rhizoctonia. State yield reduced 5%. Especially severe where peas grown without rotation. Prof. Delwiche reports pedigree "Horal" strains highly resistant compared with Hosford. (Vaughan)

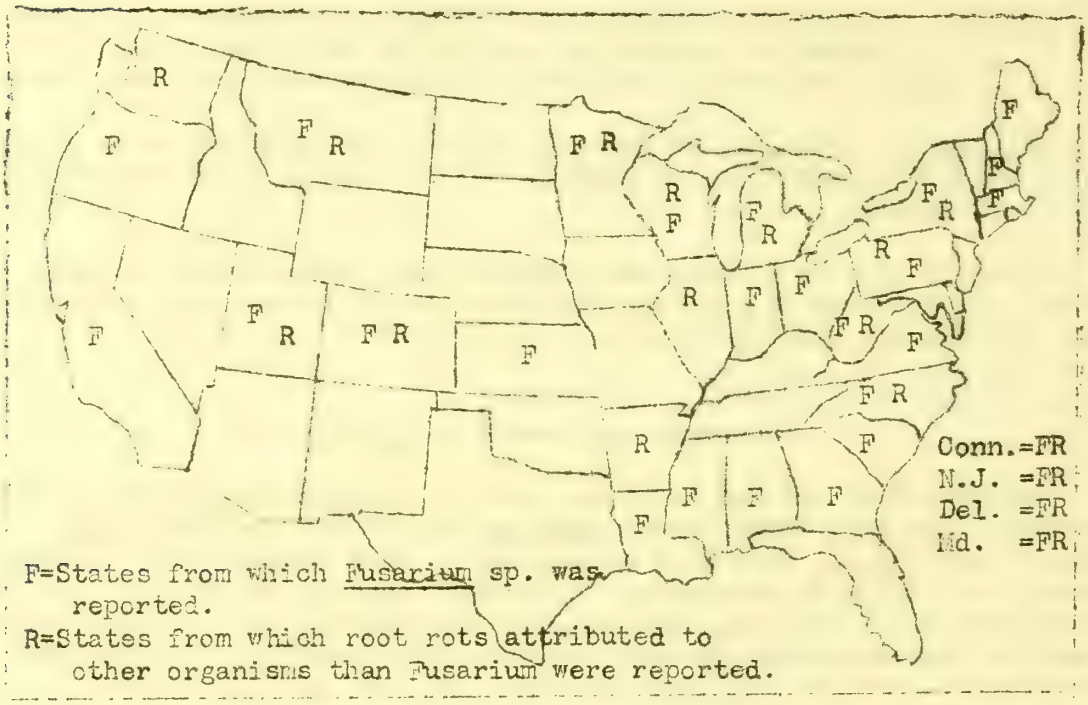

Fig. 14. Distribution of pea root rots. Data obtained from all plant disease survey reports including those of 1922. (Collaborators should check this list of states and make any additional reports they may have.)

(Root rot, several fungi) Causing considerable damage on old pea land. Some canneries estimating loss at 40%. Long rotation is vitally important to keep away from root rot. (Vaughan)

Montana: Root rot common in fields planted to peas for first time as well as in soils cropped to peas for second and third year. Number of affected plants in old fields greater than in new fields. (Jennison)

Other diseases

Bacterial blight caused by Pseudomonas pisi Sackett (?) was observed in South Carolina, Wisconsin and Montana. It was not of great importance, however. In Wisconsin a few fields were badly blighted. There was considerable on green and Scotch field peas, and on Admiral and Multiplier canning variety. There was a slight amount on Golden vine. (Vaughan)

Leaf spot caused by Septoria pisi West. was found in Minnesota and Wisconsin. It has previously been reported from the following additional states: Maine, New York, Pennsylvania, Delaware, Maryland, Ohio, Texas, Indiana, Michigan, Colorado, Montana, and California. Only Texas and

California among these may be called warm climate states. It would, therefore, be of interest to know whether the disease occurs in other Southern States or if the Septoria thrives best at the lower temperatures of the North.

Anthracnose caused by Colletotrichum pisi Pat. Fred Reuel Jones and R. E. Vaughan, in their recent article on "Anthracnose of the garden pea" (Phytopath. 11: 500-503. Dec. 1921) give the following information:

> "Anthracnose of the garden pea caused by Colletotrichum pisi Pat. has been found causing great damage to peas grown for canning purposes in two localities in Wisconsin in 1912 and 1920. At present the disease appears to be of limited distribution in America. The fungus infected readily all species of the genus Pisum that were tried, but no host outside of this genus was found."

Rust caused by Uromyces pisi (Pers.) Winter. Miss Louise Dosdall, of University Farm, Minnesota, writes regarding this disease:

> "We have found a light infection of rust on peas, Alaska Wonder. This is the first time we have found a rust on this crop in this state. As yet we have not identified the organism, but it is probably Uromyces fabae."

An Uromyces had previously been reported from Nebraska and North Dakota.

Reference

Buchheim, Alexander. Zur biologie von Uromyces pisi (Pers.) Winter Centralbl. Bakt. abt. 2, 55: 507-508. Feb. 1922.

Traces of downy mildew caused by Peronospora viciae Berk. was found in Wisconsin and in Sacramento County, California.

Damping-off caused by Fusarium sp. was reported from Florida. Cultures were made of the fungus by O. F. Burger.

Rough pod spot (non-parasitic) was mentioned as present by Dana of Washington.

Frost injury - Early plantings of peas were badly injured by frost in the Imperial Valley, California, according to C. L. Brown.

An undetermined disease was reported by D. B. Milbrath from the Carlsbad region, California, where it caused 80% loss on 900 acres.

PEANUT

Leaf spot caused by Cercospora personata (B. & C.) E. was generally present in Virginia, South Carolina and Florida. A slight amount of the disease was also seen in Arkansas.

Bacterial wilt caused by Bacterium solanacearum EFS was observed in Florida in a ten-acre field, the crop of which it nearly destroyed.

Southern blight caused by Sclerotium rolfsii Sacc. was reported from South Carolina where it manifested itself in stem, root and nut rot.

Texas root rot caused by Ozonium omnivorum Shear resulted in 8% loss in Texas. (Taubenhaus)

Chlorosis which Taubenhaus attributed to an excess of lime in the soil, was reported from Texas.

PEPPER

Leaf spot caused by Cercospora sp. was rather common in Louisiana. It apparently was more severe on the Piementos. (Edgerton)

Mosaic was said to be of minor importance in Connecticut, Louisiana, Indiana and Minnesota.

Fruit rot caused by Alternaria sp. was reported by Anderson and Tehon of Illinois.

Bacterial spot caused by Bacterium vesicatorium Doidge was serious in a few market gardens in Indiana. M. W. Gardner writes, "Kendrick and I have compared the pepper organism isolated by I. C. Jagger in Florida, with our Bacterium exitiosum and a culture of Bacterium vesicatorium obtained from Miss Doidge, and find them practically identical, so the correct name is Bacterium vesicatorium Doidge."

Wilt caused by Bacterium solanacearum EFS did considerable damage in home gardens about Roanoke, Virginia, and a trace was found in Texas.

General references

Higgins, B. B. The bacterial spot of pepper. Phytopath. 12: 501-516. November 1922.

_____ Seed treatment in the control of pepper diseases. (Abstract) Phytopath. 13: 57-58. Jan. 1923.

Leonian, L. H. Stem and fruit blight of peppers caused by Phytophthora capsici sp. nov. Phytopath. 12: 401-408. Sept. 1922.

RHUBARB

Leaf spot caused by Ascochyta rhei E. & E. was found in market gardens about Indianapolis, Indiana. (M. W. Gardner)

Leaf spots caused by Cercospora sp. (Illinois) and Phyllosticta straminella Bres. (Illinois and Minnesota) were reported.

Milbrath reports an undetermined disease as follows:

> "Lesions on stem and ribs 1-3 mm. All varieties of rhubarb affected in Southern California. 500 acres. Loss caused in transit through secondary organisms. Loss 12%."

Crown and stalk rot caused by Phytophthora parasitica var. rhei Godfrey and Phytophthora cactorum (Leb. & Cohn) Schröt. is by far the most

serious trouble of rhubarb. The former species was found in Kansas, Maryland, and Virginia. P. cactorum was found by Beach in eight fields in the Philadelphia section of Pennsylvania. One of the species (not determined) was an important rhubarb parasite in Illinois, especially in Union County (Tehon and Anderson).

References

Beach, W. S. The crown rot of rhubarb caused by Phytophthora cactorum. Pennsylvania Agr. Exp. Sta. Bul. 174: 1-28. July 1922.

Godfrey, G. H. A Phytophthora foot rot of rhubarb. Jour. Agr. Res. 23: 1-26. Jan. 6, 1923.

SALSIFY

White rust caused by Albugo tragopogonis (DC.) Gray was common in Vermont and New York.

Reference

Ritzema Bos, J. Bestrijding van de zoogenaamde "witte roest" der schorzeneeren, veroorzaakt door Cystopus tragopogonis (Persoon) Schroet. (Combating the so-called "white rust" of salsify caused by Cystopus tragopogonis.) Tijdschr. Plantenz. 26: 216-220. 1920. (Abstract in Bot. Absts. 10: Entry 1900. Feb. 1922)

SPINACH

Downy mildew caused by Peronospora effusa (Grev.) Rab. was reported from Texas (10% loss), Minnesota (trace), Washington, and California. The two following reports from California are interesting:

> "Infection in all regions where crop was grown. Disease severer than usual on account of low temperature and moisture. Loss 3 percent. Acreage 5,000. (My estimate.)" (D. G. Milbrath)

> "All spinach fields in the Imperial Valley inspected so far show infestations of downy mildew, but the damage is negligible in every case except where the stands of spinach are over thick, or where weeds or grasses have been allowed to grow abundantly, or where the spinach has been over-irrigated. In some fields the loss of marketable spinach will run from 5-15%." (W. S. Childs)

Rust caused by Puccinia subnitens Dietel. Dana, of Washington, reports, "Several carloads loss to Walla Walla growers." Barss, in Oregon, gives the following information (Phytopath. 12: 446. Sept. 1922):

> "On May 4, 1922, liberal samples of spinach leaves were forwarded to the Oregon Experiment Station by J. B. Wiley from the Walla Walla Valley. These leaves were abundantly sprinkled with the bright orange cluster cups of a rust.

> The vegetable growers of the Walla Walla Valley have sustained heavy losses on the spinach, both in the early and late crop. No losses from such a disease have been reported to the Oregon Experiment Station in previous years, and the growers in the district report no commercial losses from this cause in previous years. Inasmuch as there appears to be no common rust disease accompanying spinach production in most parts of the world it was at once expected that some native rust had attacked the spinach. Puccinia subnitens Dietel was suspected and a search for the salt grass or alkali grass Distichlis spicata which is the telial host of this rust proved that the alkali grass was one of the three most common grasses growing in the vicinity of the spinach beds.
>
> "Specimens of this grass collected by Mr. Wiley close to the spinach beds were completely covered with the telial sori of Puccinia subnitens. Cultural experiments at Corvallis under experimental control have demonstrated the ability of the rust sporidia from this material to produce aecial infections on the cultivated spinach."

Leaf spot caused by Cercospora flagelliformis E. & H. was observed in Indiana and Minnesota. The Minnesota report reads:

> "On a one-tenth acre plot at University Farm in which plants were grown for seed, the leaves were very heavily spotted, especially the lower ones. This is the first report we have of this disease in Minnesota. (Sect. Plant Path.)

Anthracnose caused by Colletotrichum spinaciae E. & H. - Texas, trace. (Taubenhaus)

Blight caused by Fusarium sp. is reported from Idaho by Hungerford (Phytopath. 12: 447. Sept. 1922), who says:

> "A rather serious disease has recently been found in several localities in Idaho. The disease appears when the plants are quite small, causing a stunting of the plants, curling of the leaves and finally the death of the plants. A species of Fusarium has been constantly isolated from the interior of the crowns and roots of the diseased plants. The characteristic symptoms of the disease have been produced upon plants grown in sterilized soil to which had been added a pure culture of the organism.
>
> "Dr. C. D. Sherbakoff, to whom a culture was sent for identification, has found that the Fusarium belongs to the Martiella-Elegans section and is sufficiently different from all previously described Fusaria to be considered a new species."

Damping-off caused by Pythium debaryanum Hesse - Connecticut - one report. (Clinton)

Mosaic did considerable injury in New Jersey, Virginia, and Indiana. In Virginia a resistant variety developed at the Truck Station will soon

supplant the commercial sorts. (Fromme) It was reported by H. D. Brown to be very serious near Evansville and New Albany, Indiana. (Gardner) In New Jersey there is a striking resemblance of the diseased plants to those affected by lack of nutrition. Mosaic appears in patches in the field rather than being distributed uniformly.

Crown rot (cause undetermined) caused 5% loss in some fields in New Jersey. It was a rot of the central shoots and crown, and was most common during the rainy weather.

Frost injured spinach around both Los Angeles and in the Imperial Valley of California. (C. L. Brown)

SWISS CHARD

Leaf spot caused by Cercospora beticola Sacc. was reported from Louisiana, Texas, and Colorado. It did only slight damage in Louisiana and Colorado. From Texas, Taubenhaus writes:

> "A serious leaf-spot frequently ruins the leaves of this plant making it unfit for market. The cause of this spot is Cercospora beticola, the same fungus which attacks the beets and as proved by cross inoculation."

A bacterial disease resembling that caused by Bacterium aptatum Brown & Jamieson is reported from Texas as follows:

> "Swiss chard affected with leaf spot, Cercospora beticola, was also found to be affected by a new disease hitherto undescribed. Cultures of the diseased material yielded a bacterial organism closely resembling Pseudomonas aptatum, which is parasitic on the beet and the nasturtium." (Taubenhaus)

Root knot caused by Heterodera radicicola (Greef) Müll. was commonly present in some soils in Louisiana.

Southern blight caused by Sclerotium rolfsii Sacc. - South Carolina - unimportant. (Ludwig)

Curly top (cause undetermined). "Stecklings planted for seed production severely affected. In some regions whole crop loss." (Milbrath - California)

DISEASES OF CEREAL AND FORAGE CROPS

IN THE UNITED STATES IN 1922.

Prepared by R. J. Haskell, Plant Pathologist, and
Jessie I. Wood, Junior Pathologist,
Plant Disease Survey.

CONTENTS

Introductory statement..... 165
Diseases of cereal crops..... 169
Wheat..... 169
Bunt..... 169
Loose smut..... 176
Flag smut..... 181
Stem rust..... 184
Leaf rust..... 192
Stripe rust..... 196
Scab..... 198
Take-all..... 203
Rosette..... 204
Helminthosporium blight.. 206
Other foot and root rots. 206
Nematode..... 207
Black chaff..... 208
Anthracnose..... 209
Septoria diseases..... 209
Ergot..... 212
Miscellaneous diseases... 214
Rye..... 215
Stem rust..... 215
Leaf rust..... 216
Scab..... 217
Anthracnose..... 217
Powdery mildew..... 217
Stem smut..... 217
Head smut..... 217
Ergot..... 218
Miscellaneous diseases... 219
Barley..... 219
Covered smut..... 219
Loose smut..... 220
Stem rust..... 220
Leaf rust..... 221
Stripe rust (see wheat).. 221
Net blotch..... 222
Stripe..... 222
Spot blotch..... 223
Scald..... 223
Root rots..... 223
Miscellaneous diseases.. 223
Oats..... 224
Smuts..... 224
Stem rust..... 226
Crown rust..... 227
Halo blight..... 230
Blast..... 230
Anthracnose..... 230
Scab..... 231
Miscellaneous diseases.. 231
Corn..... 231
Smut..... 231
Head smut..... 233
Rust..... 233
Root and stalk rots..... 233
Ear rots..... 235
Dry rot (Diplodia)..... 236
Bacterial wilt..... 237
Brown spot..... 237
Mosaic..... 238
Bacterial stalk rot..... 238
Leaf blight..... 239
Miscellaneous diseases.. 240
Rice..... 240
Flax..... 241
Rust..... 241
Wilt..... 243
Heat canker..... 244
New diseases..... 244
Sorghum..... 245
Covered kernel smut..... 245
Other diseases..... 245
Diseases of forage crops..... 246
A. Legumes..... 246
Alfalfa..... 246
Leaf spot..... 246
Rust..... 247
Yellow leaf blotch..... 248

Clover 250
Powdery mildew..... 250
Rusts..... 253
Root rots..... 253
Nematode..... 254
Miscellaneous diseases.. 254
Sweet clover..... 255
Bur clover..... 255
Cowpea..... 256
Soybean..... 256
Vetch..... 258
Velvet bean..... 258
Horse bean..... 259
B. Sunflower 259
C. Grasses..... 260
Timothy..... 260
Sudan grass 260
Miscellaneous grasses..... 260

INTRODUCTORY STATEMENT

This summary of the diseases of cereal and forage crops in 1922 is based on information obtained from various sources, chief among which are the collaborators of the Plant Disease Survey, the Office of Cereal Investigations, and the Plant Disease Survey of the Dominion of Canada (Survey of the prevalence of plant diseases in the Dominion of Canada (mimeographed). Ann. Rept. 3: 1-192, 1923). Reports from the Canadian provinces that are listed in the following pages have been taken directly from the publication just mentioned.

1922 weather conditions in relation to cereal diseases.

The weather for the months of March, April, June, and July probably influenced cereal diseases more than that of other months in 1922. March and April were unusually warm and wet over the greater portion of the eastern half of the country. May was warm and rather drier than usual throughout most of the winter wheat area. June was warmer than normal throughout the entire country, and it was exceptionally wet in the Atlantic Coast and Great Lakes states, but abnormally dry in the winter wheat area from Ohio westward. Dry weather prevailed also in the spring wheat section. The weather for this month greatly influenced such diseases as scab and the leaf diseases of cereals. July was the only warm-season month of the year with temperatures below normal in most sections of the country, although August was unseasonably cool in the middle and south Atlantic areas. The rainfall for July showed considerable irregularity in its distribution over individual states and regions. More precipitation than usual occurred throughout the greater portion of the Atlantic Coast states, but in New York, Western Pennsylvania, Ohio and parts of West Virginia, Kentucky, Indiana, Illinois and Missouri, Oklahoma and Texas there was a deficiency. During the month the spring wheat area experienced dry weather which cut down the amount of stem rust to a very great extent. The Pacific Northwest and the Southwest also had a deficiency of rainfall during July. (For more detailed discussion of weather for the year, see Pl. Dis. Bul. Suppl. 26, 1923).

Relative prevalence of cereal diseases in 1922

Influenced by weather conditions, the diseases of cereal and forage crops varied greatly in their relative prevalence. The two outstanding epidemic diseases were the powdery mildew of red clover and the leaf rusts of small grains. In addition to these the following diseases were unusually severe: bunt of wheat in the Northwest, scab of the small cereals in the Atlantic Coast States, nematode of wheat in Virginia, anthracnose of wheat and rye in Ohio, Helminthosporium leaf blight of corn in Connecticut and adjacent states, Diplodia seedling blight in parts of the corn belt, flax rust in Minnesota, alfalfa rust and the leaf spot of alfalfa in New York and New England.

Of the diseases that were not so severe as usual may be mentioned: the stem rust of cereals, stripe rust of wheat, barley and grasses, scab of the small grains in the western part of the soft red winter wheat and the spring wheat areas, take-all of wheat in New York, ergot in the durum wheat area, the smuts of oats, corn smut and flax wilt.

The majority of the remaining diseases of cereals apparently occurred to about the usual extent without marked variations in severity.

New diseases, new hosts and new occurrences.

A considerable number of new diseases were described in literature or reported to the Survey during the year. Other diseases were found in new localities for the first time and several organisms were described or reported on new hosts. These diseases have been classified and appear below in the following lists:

New diseases

Wheat

Leptosphaeria sp. - New York
Mosaic - Nebraska

Oats

Leptosphaeria avenaria Weber (Septoria avenae Frank) - Wisconsin

Corn

Bacterium dissolvens Rosen (the cause of bacterial stalk rot, previously reported from Arkansas but organism not named)

Flax

Two new diseases, causes not definitely determined.

Cowpea

Alternaria atrans Gibson (secondary), - Arizona.
Bacterium vignae Gardner & Kendrick, Indiana (observed since 1919)

Soybean

Alternaria atrans Gibson - Arizona.
Peronospora sp. - New York.
Phomopsis sojae Lehman - North Carolina.

Grasses

Pythium sp. on *Agrostis palustris* - Connecticut.

Diseases found in new localities

Wheat

Tylenchus tritici (Stein) Bast. - Haywood County, North Carolina
Urocystis tritici Kcke. - Missouri
Sclerotium rhizoides Auersw. - Idaho

Barley

Puccinia simplex (Koern.) Erikss. & Henn. - Manitoba
Rhynchosporium secalis (Heins) Davis - Canada (Alberta)

Alfalfa

Uromyces striatus Schroet. (Uromyces medicaginis Pass.) - Pennsylvania, nia, Illinois

Cowpea

Cercospora cruenta Sacc. - Illinois.

Soybean

Mosaic - Connecticut, New York, Virginia, Kentucky, Louisiana.

Grasses

Uromyces dactylidis Otth on Dactylis glomerata - Virginia

Organisms found on new hosts.

Rye

Tilletia tritici (Bjerk.) Wint. - Washington (artificial inoculation 1922, natural infection 1921)

Soybean

Bacterium solanacearum EFS - North Carolina (found in 1921)

Grasses

Ophiobolus cariceti (Berk. & Br.) Sacc. on Phleum pratense, Agrostis palustris, and Poa compressa, - all from New York
Puccinia glumarum (Schm.) Erikss. & Henn. (see under miscellaneous grasses).
Septoria bromi Sacc. on Bromus inermis, - Wisconsin (miscellaneous grasses(7)).
Urocystis agropyri (Preuss) Schröt.) on Agrostis palustris - Wisconsin

Diseases that should be kept under observation

Certain diseases of cereals and forage crops should be carefully watched during the coming seasons on account of the possibility of their becoming more widespread and destructive. They are potentially dangerous.

1. Flag smut of wheat (Urocystis tritici Kcke.) This is a disease of comparatively recent introduction and, although occurring only in a small area in the vicinity of St. Louis, it has possibilities of becoming a very serious disease, if it becomes widespread.

2. The Sclerotium disease of wheat (Sclerotium rhizoides Auersw.) was reported for the first time this year in Idaho. The only previous collection that we have a record of came from Montana. The disease should be watched for in these and in other states and observations made concerning it.

3. The head smut of corn (Sorosporium reilianum (Kühn) McAlp.) in the state of Washington and previously it has been collected in California. This disease may possibly be a menace to the corn crop.

4. The mosaic disease of corn which during 1922 was reported from Arkansas, and which in other years has been recorded in some of our other southern states, may be very dangerous potentially. If it is the same mosaic as that described from Hawaii, it certainly would be a calamity if it should become widespread and attack corn in the United States with the same severity that it does in Hawaii.

5. The bacterial stalk rot of corn (Bacterium dissolvens Rosen) reported in this bulletin from Arkansas and Illinois should be watched and studied.

6. The clover nematode (Tylenchus dipsaci (Kühn) Bastian) that occurs in some of the northwestern states needs continued observation in the states where it occurs and in adjoining territory. Since much of the clover seed that is planted in the East comes from the western seed producing areas, the disease should be watched for in the East also.

7. The powdery mildew of clover which, during the past two years, has been epidemic, deserves further study and observation to explain its unusually wide prevalence.

Mosaic diseases

Mosaic diseases were reported on the following hosts during 1922: wheat in Nebraska, sweet clover in Minnesota, cowpea in Arkansas and Indiana, soy bean in Connecticut, New York, Virginia, Kentucky, Louisiana, and Indiana, and corn in Arkansas.

DISEASES OF CEREAL CROPS

WHEAT

Bunt caused by Tilletia laevis Kühn and T. tritici (Bjerk.) Wint.

In the summaries of the wheat bunt situation for other years it has been brought out that of the two smut fungi causing bunt, Tilletia laevis and T. tritici, the former, T. laevis, is by far the more widespread in the United States, it being the form that occurs commonly throughout all of the eastern states. T. tritici on the other hand is not important or common east of the Rocky Mountains, but it is the important form west of the mountains in the northwestern wheat region, and it is in this area that the heaviest losses from bunt occur. Regarding the geographic distribution of bunt in western United States, Stephens and Woolman (7) report as follows:

> "West of the Rockies Tilletia tritici is by far the more prevalent. According to Prof. W. W. Mackie, of the University of California, it is practically the only species found in California. The two (smuts) occur in Western Oregon, and in the Willamette Valley in particular, where they are about equally abundant. In the wheat belt of Eastern Oregon and Washington and Northern Idaho, or what is generally called the Inland Empire, T. laevis has not been found in the field. It does, however, occur in Southern Idaho, notably around Pocatello, where in 1918 it was found by the junior writer in wheat stored in warehouses."

The question as to why Tilletia tritici is the important smut in the West, and T. laevis is the prevalent one in the East, is an interesting one and a subject for further study. Possibly some light may be thrown on this point by the observations of R. S. Kirby of New York, 1922, who reported that T. tritici was brought into New York from the state of Washington in Number Four wheat, but that the percentage of this smut is rapidly becoming smaller each year without any seed treatment.

In 1922 bunt was reported from the majority of the states in the country. Most of these reported it as being prevalent in about the same, or perhaps slightly less amounts than, last year. Maryland and Virginia, however, estimated more, as also did all of the northwestern states.

Of the eastern states only four reported more than a trace of bunt. Elliott estimated 2% loss in Arkansas and makes the statement that many farmers do not treat their seed until they experience very heavy losses. In Illinois, where this year a systematic examination of wheat fields was made by the Natural History Survey, a large area in the northern part of the state was found where bunt was abundant. As a result of their survey, it was estimated that the disease occurred in about 40% of the fields in the state and that the reduction in yield was probably not far from 2%. The presence of bunt in wheat caused a considerable dockage at elevators and mills in Illinois. Maryland, Virginia and Tennessee estimated 1% loss from bunt in 1922.

Table 63. Estimated loss of wheat from bunt, according to collaborators, 1922.

Approximate percentage loss.	States
8	Idaho
5	Washington
2	Arkansas and Illinois
1	Maryland, Virginia and Tennessee
1/2	California
Trace	Massachusetts, New York, Pennsylvania, Delaware, West Virginia, Ohio, Indiana, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Kansas, Colorado.

Table 64. Highest percentages of bunt in individual fields, according to collaborators, 1922.

Highest percentage	States
50	Michigan, Kansas, South Dakota, Colorado, Idaho.
35	Washington
15	Ohio
12	Iowa
10	Georgia, Illinois, Minnesota, North Dakota.
8	Pennsylvania
6	New York

As will be seen from the following reports, bunt was reported as being much more prevalent in the Northwest this year than last.

Montana: More stinking smut this year in fields where seed grain was not treated. (Jennison).

Idaho: Much worse in northern Idaho than last year, many fields having from 20 to 45%. Very important on all dry land wheat. (Hungerford).

Washington: More than average amount of smut in the Palouse country. One hundred eighteen counts of 1,000 heads each were made on 61 farms scattered over eastern Washington. They showed an average of 8.4% smut in the crop. This may be taken as a fair average of the entire acreage. Counts ranged from 0 to 35% smut. A number of smut explosions occurred in thrashing machines. (Dana).

Oregon: Appears to be worse than last year, loss of half a million dollars is estimated for Umatilla County,- the largest in wheat production in the state. (Barss).

California: Continued reduction of bunt is apparent in this year's crop. The effects of the smut campaign are evidently apparent in the reduction of bunt. It is estimated that the attack will average less than one half of 1%, with many areas averaging less than one tenth of 1%. Many thousands of acres smut-free. (Mackie).

Factors influencing the amount of bunt

The question arises as to the reason for the increase in the amount of bunt in Montana, Idaho, Washington, and Oregon. In a recent paper, Hungerford (5) has shown that low soil temperatures and a fairly high percentage of moisture in the soil at seeding time, are conducive to bunt infection. In a series of controlled greenhouse experiments, he found that the highest percentage of infection was secured at temperatures ranging from 9 to 12°C. (48 to 54°F), and in soil containing 22% moisture and with a moisture equivalent to 20.7. At the highest temperatures there was a falling off in the amount of disease, and in soils where there was an extremely high percentage of moisture, infection seemed to be inhibited.

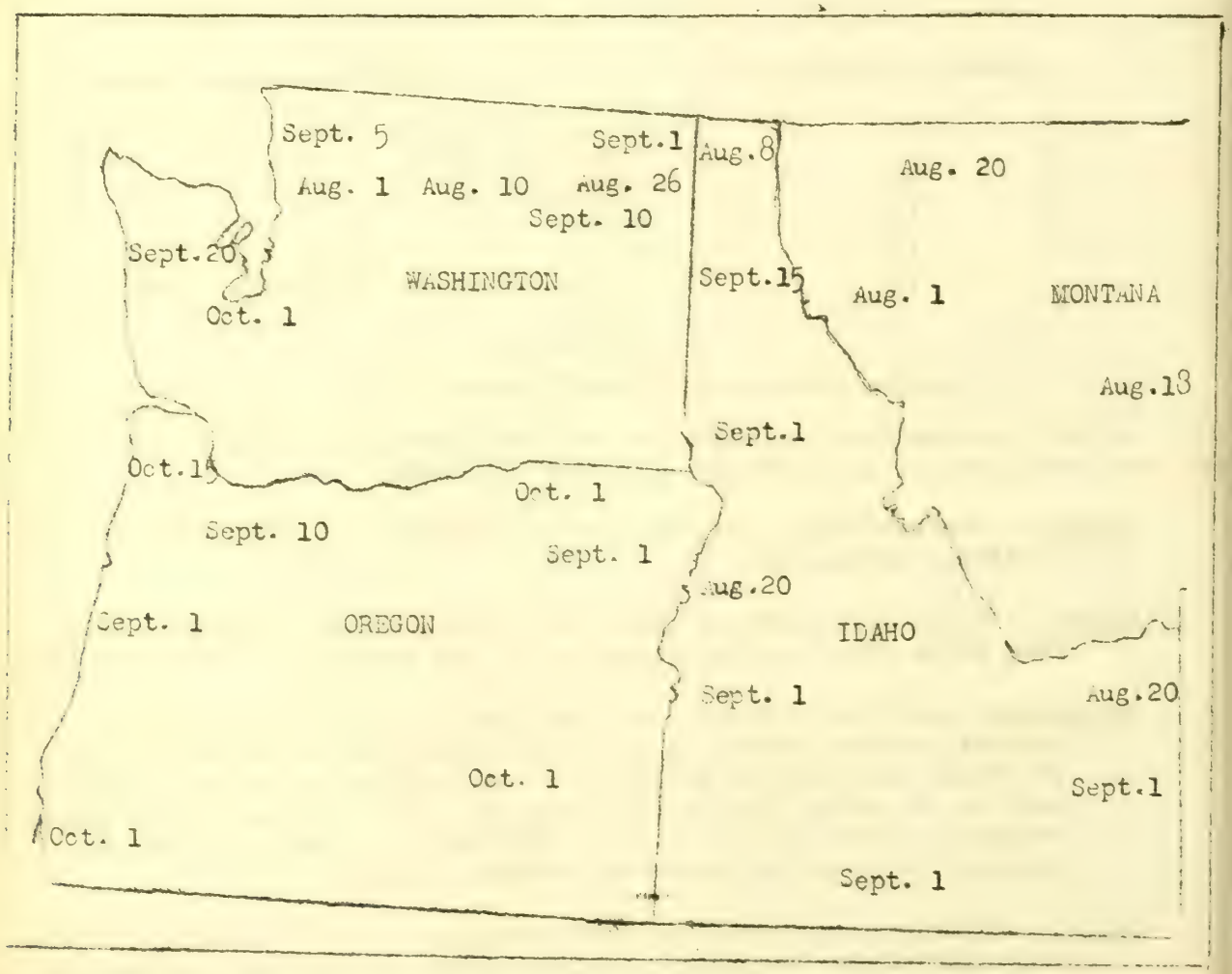

Fig. 15. Dates when seeding of winter wheat begins (Seedtime and harvest. U. S. D. A. Circ. 183. 1922).

In another recent report by C. O. Johnston (6), the statement is made hat in Kansas "Later dates of planting show consistently higher percentages of unt than the earlier plantings, the amount of smut gradually increasing in con- ecutive plantings from September 15 to November 1, after which the percentage f infection rapidly declines." This statement tends to bear out that of Hungerford that cooler temperatures, up to a certain limit, favor infection.

In the four northwestern states just mentioned, seeding of winter wheat akes place, for the most part, during September, as is shown by the accompany- ng map (Fig. 15). In looking up the temperatures for September 1921, it was found that during the month there was a great deficiency, a large proportion of the area having temperatures 3° below normal for the month (See Fig. 16). For Washington the statement is made (Climatological data for the United States by Sections: 8 Sept. 1921) that the month was unusually cool for September, the monthly mean being 55.1°. In 32 years the only September that appears to be cooler for the state as a whole was that of 1895. For Idaho it is recorded that the temperature for September 1921 was second lowest for the month since state-wide records began in 1895. The monthly mean for the state was 53°. In Oregon the temperatures east of the Cascade Mountains ranged from 2 to nearly 10° below normal with a monthly mean for the entire state of 56.2°.

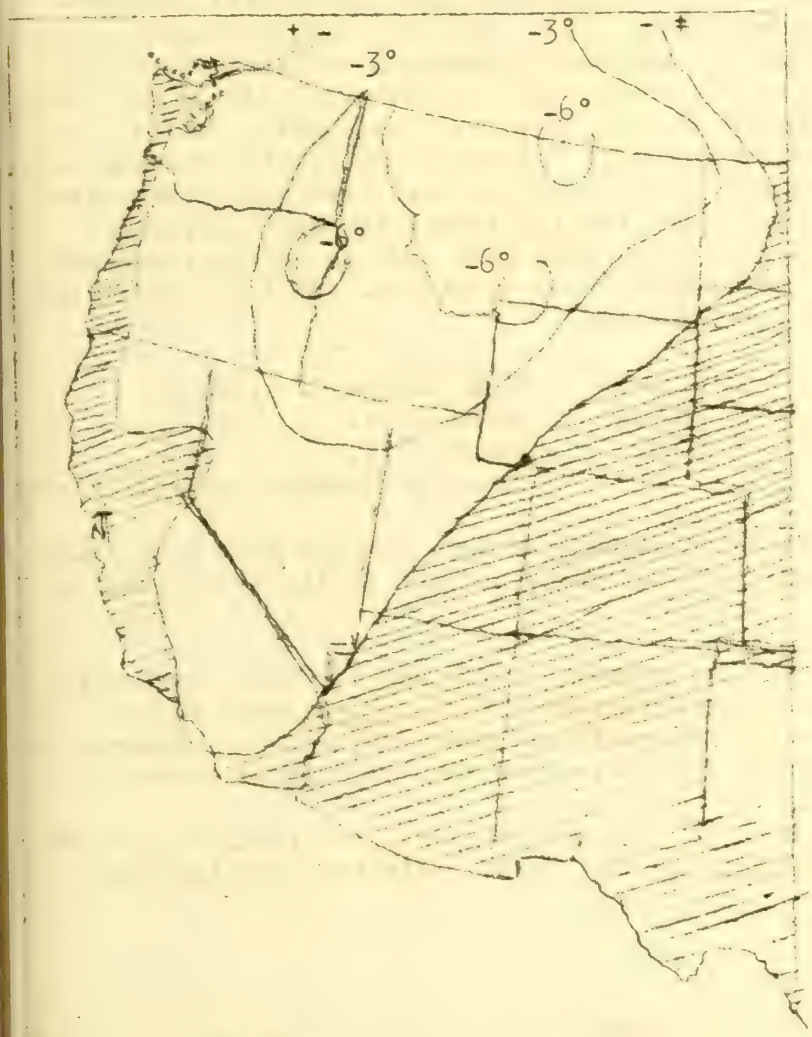

Fig. 16. Departure from normal temperature September 1921. Shaded area represents excess, non-shaded area, deficiency. (Climatological Data 8 (9). September 1921).

An examination of the precipitation records for the same month does not show anything very unusual. Rainfall varied widely in different parts of the states. If anything, conditions were somewhat drier than usual in the eastern parts of Washington and Oregon and in Idaho. However, there was apparently plenty of moisture to favor infection with bunt. While the compilers of this summary

do not claim that there is necessarily any distinct correlation of bunt infection in the Northwest and the cool temperatures of September 1921, nevertheless, the facts are at least somewhat significant and suggestive.

Varietal susceptibility

During 1922 the work of testing varieties for their susceptibility and resistance to bunt was continued in a number of places. The most important work along this line that has appeared is that of Stephens and Woolman (7), who report the results of their experiments since 1917. The project they report is a co-operative one between the Oregon Agricultural Experiment Station and the Office of Cereal Investigations of the Department of Agriculture. All of the commercial wheat varieties of the United States, Australia, and India, as well as entries of pure-line selections of wheat varieties were tested for smut at Moro for the two years 1919 and 1920. As a result of this work a few pure-line selections were discovered that seem to be totally immune to both species of stinking smut, and nearly 20 varieties were found that were so highly resistant to bunt that they can safely be sown without seed treatment. Of these varieties, those appearing most promising are as follows:

Turkey C. I. 1558 A	Turkey C. I. 1571 C	White Odessa C. I. 4655
Turkey C. I. 1558 B	Crimean C. I.2903-5	Martin C. I. 4463
Turkey C. I. 3055	Crimean C. I.4430	Hussar C. I. 4843
		Turkey x Florence(Several hybrids)

These wheats have been tested for yields and some of them have been found to be very satisfactory for Oregon. The discovery of them is likely to prove of much economic importance.

In Kansas, C. O. Johnston (6) has reported that Kanred, while apparently resistant to Tilletia tritici, is no more resistant to T. laevis than Turkey, Kharkof, or other hard winter wheats. The soft red winter wheats as a group seem to be somewhat more susceptible to T. laevis than do the hard winter varieties.

From South Africa, J. E. Donkin (3) reports that of 20 varieties of wheat tested for resistance to bunt (T. tritici), the durum, polonicum and turgidum types showed evident resistance.

Bunt control

During the past year the copper carbonate dust treatment for bunt of wheat has been tested at a number of places, and in the majority of cases considerable success has been reported in its use. The following reports are from individual investigators.

Michigan (2): Copper carbonate, copper sulphate and lime dusts, using heavily smutted winter wheat, have given the following results in comparison with the standard formaldehyde treatments in stinking smut control:

WHEAT - Bunt

Treatment	Percent of smut	Stand Per cent
Control	46	100
Dry formaldehyde	3	98
Wet formaldehyde	0	97
Soak and skim formaldehyde method	0.5	97
Copper sulphate and lime dust, 2 oz. per bu.	3.7	97
Untreated	44	100
Copper carbonate, 4 oz. per bu.	2.6	98
Untreated	15.7	100
Copper carbonate, 2 oz. per bu.	1.4	97
" " 4 " " "	2.4	95
" " 8 " " "	0.9	90
" " 16 " " "	0	90
Untreated	33.3	100
Copper sulphate and lime dust 2 oz. per bu.	4.6	98
" " " " " 4 " " "	4	97
" " " " " 8 " " "	2.6	93
" " " " " 16 " " "	4.2	90
Control	44	100
Copper sulphate dehydrated, 2 oz. per bu.	3.1	85
" " " 4 " " "	4.3	80
" " " 8 " " "	0.5	80
" " " 16 " " "	2.1	80
Sulphur, superfine, 2 oz. per bu.	14.	100

Considering the heavy smut production in the controls and the marked reduction brought about by both copper carbonate and copper sulphate and lime dusts, it is believed that use of these with fairly clean grain would give satisfactory stinking smut control. Tests with oats were not satisfactory in smut control. (G. H. Coons).

North Dakota: Copper carbonate tried in many localities, but smutted wheat seed was not available for check. Smutted Marquis at Fargo developed very few smutted heads. (Wanda Weniger)

South Dakota: Excellent results with copper carbonate. (Evans)

Idaho: Tests have been made during the last two years with several dust treatments for the control of stinking smut. None of these treatments have given as good control of this disease as the standard bluestone treatment, 1 pound bluestone to 5 gallons of water, under the conditions where they have been tried.

Preliminary tests carried on in 1921 seemed to indicate that copper carbonate was not effective when applied to badly smutted seed but might be effective with seed not heavily smutted. In order to test this question as well as to compare the efficiency of copper carbonate dust and bluestone under the same conditions an experiment was conducted, the results of which are given in the following table. It will be noted that in no case was complete control secured. This was doubtless due to especially heavy soil infection which prevailed this year.

Table 65. Seed treatment tests in Idaho, 1922.

Amount of smut by weight (inoculum)	Percentage of bunt (average of 3 counts) Copper carbonate: 2 oz. to bushel	Copper sulphate (bluestone) 1 lb. - 5 gal.	Control, not treated
1 - 10,000	16	5 1/2	25
1 - 5,000	22	12	25
1 - 1,000	23	10	55
1 - 500	17	11 1/2	52
Stand	58	35	50

(C. W. Hungerford).

Washington: The following table of comparison is given by Heald and Smith (4)

Table 66. Comparison of dust and wet seed treatments, Washington, 1921.

Treatment	Bluestem			Jenkins Club		
	Per cent germination	Per cent smutted plants	Per cent smutted heads	Per cent germination	Per cent smutted plants	Per cent smutted heads
Check, untreated	84.25	15.06	13.6	89.5	4.5	3.2
Bluestone, wet	67	0	0	65.5	1.2	0.4
Formaldehyde, wet	38.5	0	0	53.5	1.1	0.7
Chlorophol, wet	94.5	0	0	96	0	0
Copper carbonate 2 oz. Dust	91.5	0	0	92	0	0
Copper carbonate 4 oz. Dust	98.5	0	0	96.5	0	0
Copper sulphate - calcium carbonate (equal parts) 2 oz. Dust	92.5	0	0	94.5	0	0
Sulphur, 10 lbs. Dust	89	0.5	0.2	92	0	0
Sulphur, 20 lbs. Dust	94	0	0	93.5	0	0

Oregon(1): In the fall of 1921 statewide tests were started in Oregon by various county agents under the direction of the Experiment Station pathologist. Records of about a hundred such tests have been turned in, and the results are so satisfactory in general that the Experiment Station is encouraging more extensive testing of this method this fall. The results in other Coast states are likewise encouraging. Universal adoption of this method will not be advocated until the results of further tests fully confirm the apparent advantages of the dust treatment. (H. P. Barss)

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(5) Hungerford, Charles W. The relation of soil moisture and soil temperature to bunt infection in wheat. Phytopath. 12: 357-352. 1922.
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Coons, G. H. Copper-dust treatment for stinking smut. Quart. Bul. Mich. Agr. Exp. Sta. 5: 8-11. 1922.
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Salmon, E. S. ... safe method of preventing "bunt" in wheat. Jour. Min. Agr. Great Britain 29: 722-728. Nov. 1922.
Woolman, H. M. Cytological studies on the infection of wheat seedlings by Tilletia tritici (Bjerk.) Wint. (Abstract) Phytopath. 13: 36-37. Jan. 1923.
Zade, Adolf. Die bekämpfung des weisensteinbrandes mittels des formalinauslaugungsverfahrens. Illustr. Landw. Zeit. 42: 51-52. 1922.
Zundel, G. L. The effects of treatment for bunt on the germination of wheat. Phytopath. 11: 469-484. 1921. (Mar. 1922)

Loose smut caused by Ustilago tritici (Pers.) Jens.

During 1922 loose smut occurred widely over the United States as usual and according to collaborators' reports it was about normal in severity. In Washington, Oregon, and California only a very slight amount of the disease was reported. In southern Idaho, however, this smut is reported by Hungerford as being on the increase, probably causing a loss of about 1 1/2% during 1922.

By far the greatest losses occurred in the soft red winter wheat belt and in the same states where the heaviest losses from leaf rust were experienced. Collaborators in Virginia, South Carolina, Indiana, Kentucky, Arkansas and Idaho list loose smut as the second most important wheat disease in 1922, and those in Delaware, Maryland, and West Virginia list leaf rust as a most important disease with loose smut and scab as second in importance. The accompanying map (Fig. 17) shows the estimated percentages of loss from loose smut in 1922 and table 67 shows the highest percentage if loose smut in any one field.

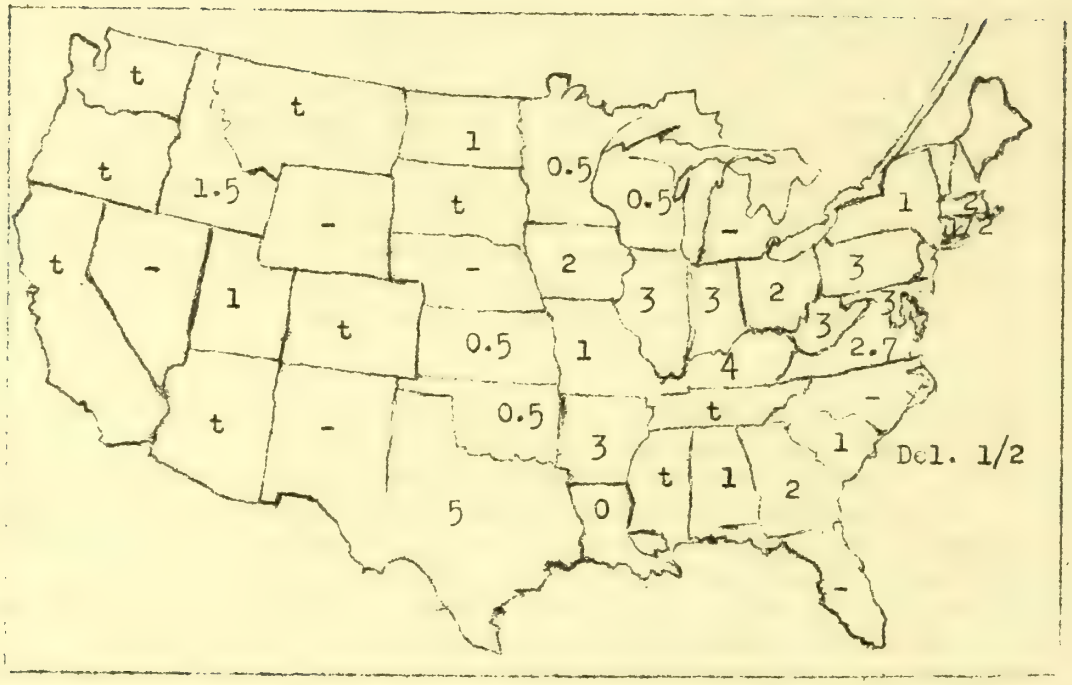

Fig. 17. Estimated percentage of loss from loose smut of wheat in 1922.

Table 67. Highest percentages of loss from loose smut of wheat in any one field as reported by collaborators, 1922.

Highest percentage of loss	States
20	Georgia
18	Ohio
10	Virginia, Illinois, Missouri
8	New York, West Virginia
5	North Dakota
3.5	Oklahoma, Arkansas
2	Delaware, Wisconsin, South Dakota

A number of factors have been reported as influencing the occurrence and severity of loose smut. Thus Coons (Phytopath. 8: 70. 1918 and Pl. Dis. Bul. Suppl. 15: 121. 1921) has reported that winter killing of wheat results in a reduction of loose smut on account of the greater susceptibility of infected plants to freezing injury. Fromme (Phytopath. 10: 53. 1920) has observed that percentages of loose smut are higher in soils of low fertility. Again collaborators in the states on the Pacific Coast have called attention several times to the fact that loose smut is of minor importance in that region, giving as a reason the dry weather conditions that prevail at flowering time. Recent studies with wheat varieties are showing that there is a wide difference in the susceptibility of various wheats to loose smut. It has been pointed out (Pl. Dis. Bul.

Suppl. 21: 152. 1922) that in 1921 the heaviest losses from loose smut occurred in the soft red winter wheat area. An examination of the accompanying map (Fig. 17.) and a comparison of it with a map showing the production of soft red winter wheat shows that the same correlation holds for 1922. It will be noted also that Hungerford, in Idaho, reported a loss of 1.5%. He observed that the disease was becoming increasingly severe in the southern part of the state on Dicklow, a common white wheat which is especially susceptible to loose smut. Fig. 18 shows that practically all of the Dicklow wheat grown in the United States is produced in southern Idaho, which accounts for the high loss there as compared with neighboring states.

Fig. 18. Distribution of Dicklow wheat in the Pacific Northwest. Each dot represents 1,000 acres or fraction thereof per county. (Map taken from U. S. Dept. Agr. Bul. 1301, Dec. 1922.)

The subject of resistance to loose smut has been given considerable attention in Survey summaries for other years (Pl. Dis. Bul. Suppls. 15 and 21). In Supplement 15 there were summarized the results obtained in the cereal survey of 1919. Below in Table 68. are listed the susceptible and resistant varieties as reported by collaborators to the Plant Disease Survey. This is a summary of all data submitted by collaborators up to and including 1922.

In a recent article Fromme (1) presents experimental evidence showing differences in the susceptibility of varieties to loose smut infection. He finds a greater amount of loose smut in bearded than in beardless varieties in Virginia and gives further data showing the susceptibility of Stoner and the resistance of Leap (Leap's Prolific). In his collaborator's report Fromme has made the statement that the resistance in Leap is probably due to inherent immunity rather than disease escape.

Very little information concerning treatment by the hot water method was sent in by collaborators during the year. It is known that considerable work is being done in the states where the disease is most important, but in the majority of the other states the disease is so unimportant that no attention to the control of loose smut seems necessary. Tapke (2) has recently presented evidence to show that the reductions in yield from seed treated by the modified hot water method are due to the fact that injury takes place through the broken seed coats. Carefully hand-threshed seed, when treated with the hot water method, showed little or no injury.

Literature
(Cited)

(1) Fromme, F. D. Incidence of loose smut in wheat varieties. Phytopath. 11: 507-510. December 1921.

(2) Tapke, V. F. Modified and simplified hot water and vapor treatments for control of loose smut in wheat, with special reference to seed injury. (Abstract) Phytopath. 13: 38. 1923.

Table 68. Varieties of wheat listed by collaborators as susceptible or resistant to loose smut. Summary of all collaborators' reports in Survey files.

SUSCEPTIBLE

Year	State	Variety	Year	State	Variety
1908	New York	Dawson's Golden Chaff	1920	Idaho	Dicklow (very)
1918	Maryland	Fulcaster, Dietz, Stoner, Mammoth Red, Bearded Purple Straw		Virginia	Stoner, Fulcaster
	Michigan	Goens	1921	Michigan	Red Rock
	New Mexico	Turkey Red		New York	Dawson's Golden Chaff, Red Rock
1919	Alabama	Mediterranean Blue Stem, Fulcaster		Ohio	Goens, Red Wave, Portage, Gladden
	Colorado	Turkey Red, Marquis		Penna.	Red Rock, Pennsylvania 44
	Georgia	Blue Stem, May		Virginia	Stoner, red Wonder, Fulcaster
	Idaho	Dicklow			
	Indiana	Red Wave, Poole	1922	Virginia	Stoner, Fulcaster
	Minnesota	Velvet Chaff, Marquis, Durum, Blue Stem		North Dak.	Preston, Durums
	Texas	Mediterranean Blue Stem, Turkey Red		Idaho	Dicklow
	Virginia	Bearded Winter, Stoner			

RESISTANT

Year	State	Variety	Year	State	Variety
1908	New York	Jones' #5	1921	New York	No. 6 Junior
				Ohio	Trumbull
				Oklahoma	Kanred, Black Hull Turkey
1919	Idaho	Forty Fold		Virginia	Leap's Prolific, Fultz
1920	Virginia	Leap's Prolific	1922	Virginia	Leap's Prolific
1921	Minnesota	Wisconsin Wonder			
				New York	No. 6 Junior

WHEAT - Flag smut

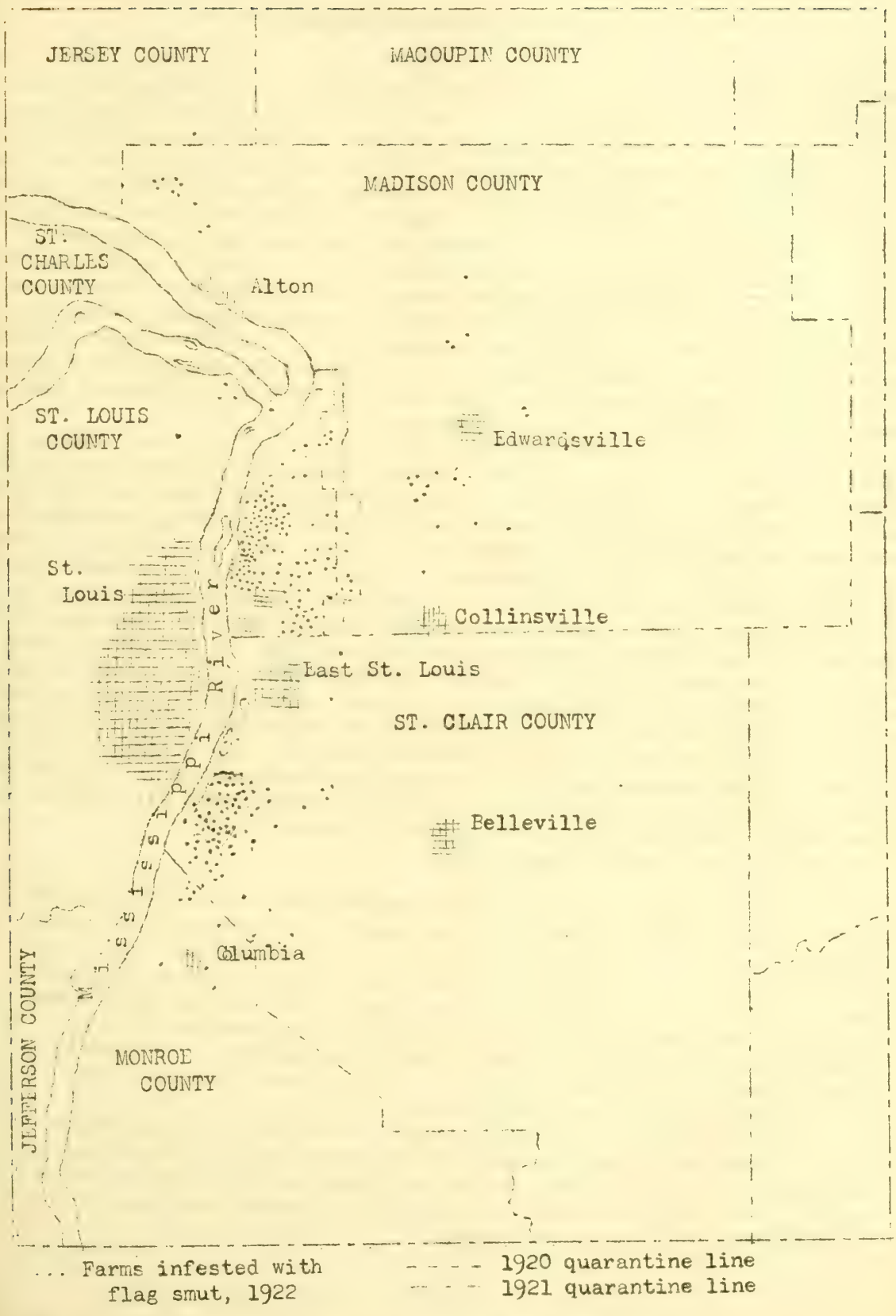

Fig. 19. Present known distribution of flag smut of wheat.

WHEAT - Flag smut

Flag smut caused by Urocystis tritici Koke.

At the close of the wheat season of 1921 flag smut was known only in the western part of Madison and St. Clair Countiies, Illinois. During that year careful search for the disease, on both sides of the Mississippi River from Cairo, Illinois to St. Louis, Missouri and in parts of the Missouri and Illinois River valleys had resulted in the discovery of an infested area where the flag smut was present in 57 infested fields on 30 farms in St. Clair County, Illinois. In addition to this the original Granite City or Madison County section had been enlarged and extended further by the finding of 100 more infested fields.

Flag smut survey in 1922: In the survey for flag smut in 1922 the following agencies co-operated: The Illinois State Department of Agriculture, the Missouri Agricultural Experiment Station, the Illinois Natural History Survey, and the U. S. Department of Agriculture represented by the Plant Disease Survey and the Office of Cereal Investigations. In all over 1200 farms were examined in Madison, St. Clair, Monroe, Jersey and Macoupin Counties, Illinois, and in St. Louis and St. Charles Counties, Missouri.

As a result of the survey the area of known infestation was increased from 72 to about 700 square miles. Two new Illinois counties were added to the list of those in which the disease occurs and the smut was discovered for the first time in the State of Missouri on four farms in St. Louis County, opposite the infested area in Madison County, Illinois. The area where the disease is now known to occur, roughly speaking, occupies a strip about 50 miles long from 5 to 1 miles wide along the east bank of the Mississippi from southern Jersey to northern Monroe County. The smut was found on about 226 farms, the approximate location of which is shown on the accompanying map (Fig. 19). Approximately 283 of the farms inspected were within the quarantined area of last year and of these 155 or 55% were found to have flag smut. Outside of the 1921 quarantine zone, flag smut was found on 71 or 8% of the 900+ farms inspected. Since the work in the various localities was done by different groups of men, it seems best to report more detailed results according to the following sections: (1) inside the Madison County area, (2) outside the Madison County area, (3) work in St. Clair and Monroe Counties, and (4) survey in Missouri.

1. Inside the Madison County area:

> "Every wheat field within the quarantined area was inspected for flag smut.....The disease was found quite generally throughout the area in amounts ranging from the slightest trace to as high as possibly 2%. The entire planting inside this zone was supposed to be of two varieties, Red Wave and Turkey 10-110, the seed being obtained from sources outside the quarantin and treated at the central dipping plant with copper sulphate and lime. The total wheat planted in the area was about 12,600 acres, 10,500 being Red Wave and 2100 Turkey 10-110.
>
> "In the Red Wave, 32 infections were found on ground which was in wheat the year previous; 48 on ground, part of which was in wheat the previous year and 10 on ground not in wheat the year before." (H. B. Waterbury, in charge of Illinois State Department of Agriculture in Madison County.)

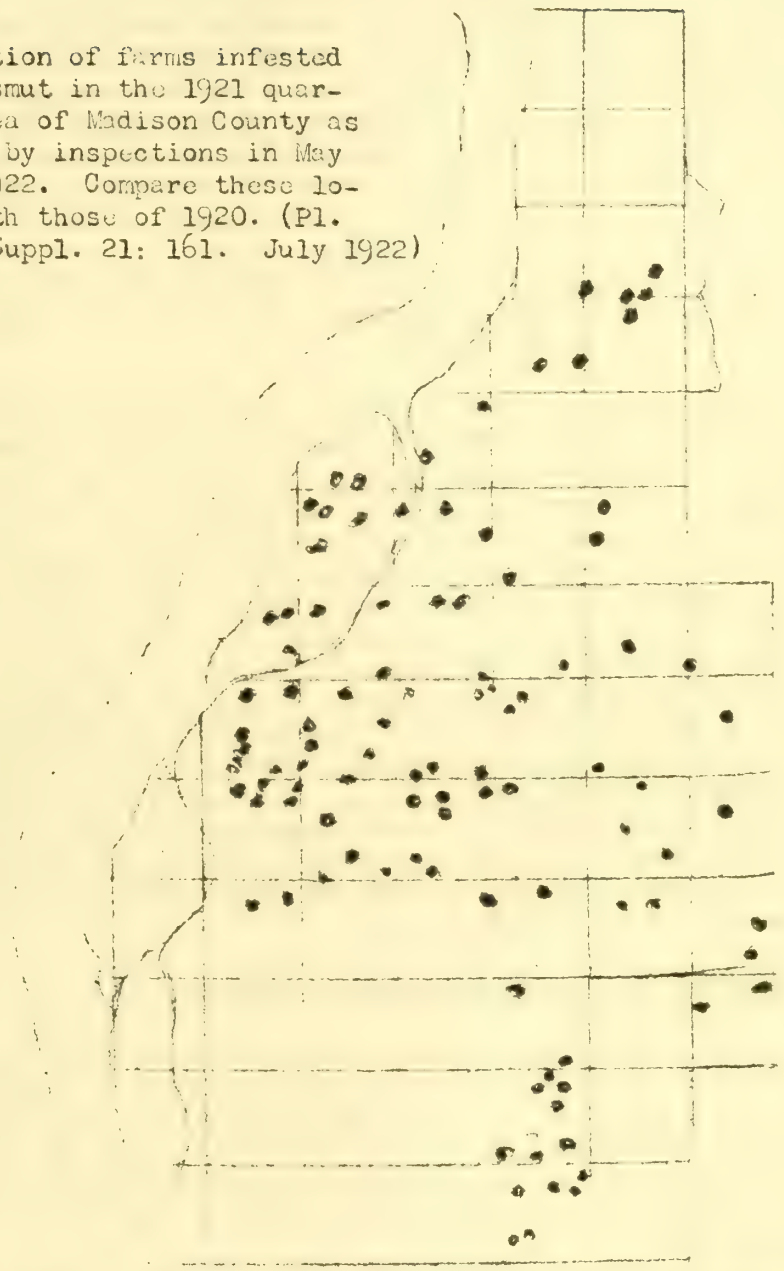

Fig. 20. Location of farms infested with flag smut in the 1921 quarantined area of Madison County as determined by inspections in May and June 1922. Compare these locations with those of 1920. (Pl. Dis. Bul. Suppl. 21: 161. July 1922)

2. Outside the Madison County area: About 270 farms were inspected and 30 of these, distributed over an area of approximately 240 square miles, were found infested. This area added to that under quarantine makes an area of approximately six times that known to be infested in 1921. Infections were found as far as 12 miles outside of the quarantined area. Regarding the work in this territory, R. D. Rands, representing the U. S. Department of Agricultue, reports as follows:

"In judging the results of the inspection work the extent to which flag smut has been found in these outposts of infection should be borne in mind. In most fields it was a mere

trace, not easily expressed on a percentage basis. In limited areas in the vicinity of straw stacks in two cases and along borders or in portions of some fields where there was apparently an accumulation of infected material from washing of the soil, infections of 5-30% were recorded. On the whole, therefore, it is evident that with but a limited time for examining particular fields inspection alone as a means for determining the presence or absence of the disease is an uncertain method."

Considerable evidence was obtained showing that the threshing machine, in addition to the seed and wind, is important in disseminating the spores of flag smut. Regarding this, Rands states:

"That thrashing machines are a common carrier of this smut from farm to farm, just as they are known to distribute bunt spores, wild onions, cockle and volunteer rye, is probable if we may judge from our success in locating advance infections by following threshing runs. For example, we have frequently found flag smut on farms surrounded by apparently disease-free ones, located long distances from the nearest known infection where the farmer had for many years used his own wheat for seed, but usually where an infected crop had been threshed ahead of his in another part of the same run. While it is of course possible that the smut was carried to such farms by wind or other agents, it seems more likely that the threshing machine or bundle wagon were responsible. Out of 8 infected threshing runs located 1-1/2 to 12 miles outside the quarantine border, a fairly even distribution of flag smut throughout the run was shown in five. The other three were only partially infested so that after finding it in the first portion of each of these runs, no more farms were at the time inspected."

3. Work in St. Clair and Monroe Counties:

"Within the St. Clair quarantined area of 1921 there were 3,398 acres in wheat this year. This comprised 194 fields, 87 of which were infested with flag smut, the degree of infestation ranging from a trace to as high as 22% in parts of fields where the infection was heaviest. Of these 87 infested fields, 74 were in wheat last year and the remaining 13 fields were in crops other than wheat.

"Within the quarantined area the infestation appears to be lighter than it was last year. In certain fields that were heavily infested last year and were in wheat again this year, fewer infected plants were found than were found last year.

"Outside of the area quarantined, several hundred farms were inspected, on 24 of which flag smut was found. The degree of infection in these ran from the merest trace to the heaviest infection which was found, 30% in a part of one field, which lay just outside of the old quarantine area.

"As we inspected further from the quarantined area, the infestation became progressively lighter, both as regards the number of fields infested and the number of plants infected. Some of this smut material was evidently carried by threshing machines into this area. The results of our inspection indicate that we have reached

the limits of the infested area." (James B. Conard, In Charge of the Illinois Department of Agriculture Survey, St. Clair County).

4. Survey in Missouri: Flag smut was found by Dr. E. F. Hopkins on June 3 on a farm near the junction of the Missouri and Mississippi Rivers, St. Louis County, Missouri. This farm was on bottom land that overflowed when the river was at its greatest height. A few days later the disease was discovered by the Plant Disease Survey men on three other farms in the uplands. From a survey of the conditions that might have brought about the introduction of the disease into this locality, it appears that spores were either blown across the Mississippi River by the wind or came in on seed from St. Louis.

1922 quarantine measures: The areas in Illinois where the disease was found were put under quarantine and the following restrictive measures required: (1) Disinfection of wheat with formaldehyde at the threshing machine. (2) The requiring of elevators, mills, or dealers in wheat to see to it that all wheat from the infested area is disinfected before shipping to other persons or dealers inside the counties of Madison, St. Clair, and Monroe. (3) Restrictions on the movement of wheat straw outside the area. (5) Regulations regarding the movement, disinfection, and operation of threshing machines.

Stem rust caused by Puccinia graminis Pers.

Taking the United States as a whole, the year of 1922 can be considered as one during which the losses from stem rust were not especially great. In general there was less stem rust in 1922 than in 1921. Of all the collaborators reporting the disease, none regard it as worse than last year, and only five (Pennsylvania, West Virginia, North Dakota, Kansas, and Oklahoma) mention it as being of the same prevalence as in 1921. The only states where the disease was considered of much importance were Texas, where the rust winters over, Oklahoma, and in the spring wheat states. As usual, the damage occurred mostly in the hard red spring wheat area, the heaviest losses taking place in eastern North Dakota and western Minnesota where reduction in yields of 10% and 5%, respectively, were recorded. Cass County, North Dakota, seemed to be the center of the damaged area. In that County alone it is estimated that about one quarter of the wheat crop was destroyed on account of black stem rust. In Wisconsin, spring wheat that was planted late was badly damaged. The other spring wheat states - South Dakota, Nebraska, and Iowa - suffered somewhat but to a much less degree.

The accompanying map shows the estimated average reductions in yield, according to collaborators. It will be noted that most of the recordable losses occurred in the barberry eradication area and that the states in the western part of the area suffered practically no loss from the disease. Outside the eradication area it will be seen that 10% loss was reported from Texas where the disease wintered over and, starting early, spread northward to some extent. It is undoubtedly true that considerable loss took place in Oklahoma, but estimates are not available for that state. Of the other states, only Maryland, Arizona, and Utah estimate any recordable damage.

The following statements from collaborators give information concerning the prevalence and destructiveness of stem rust during 1922:

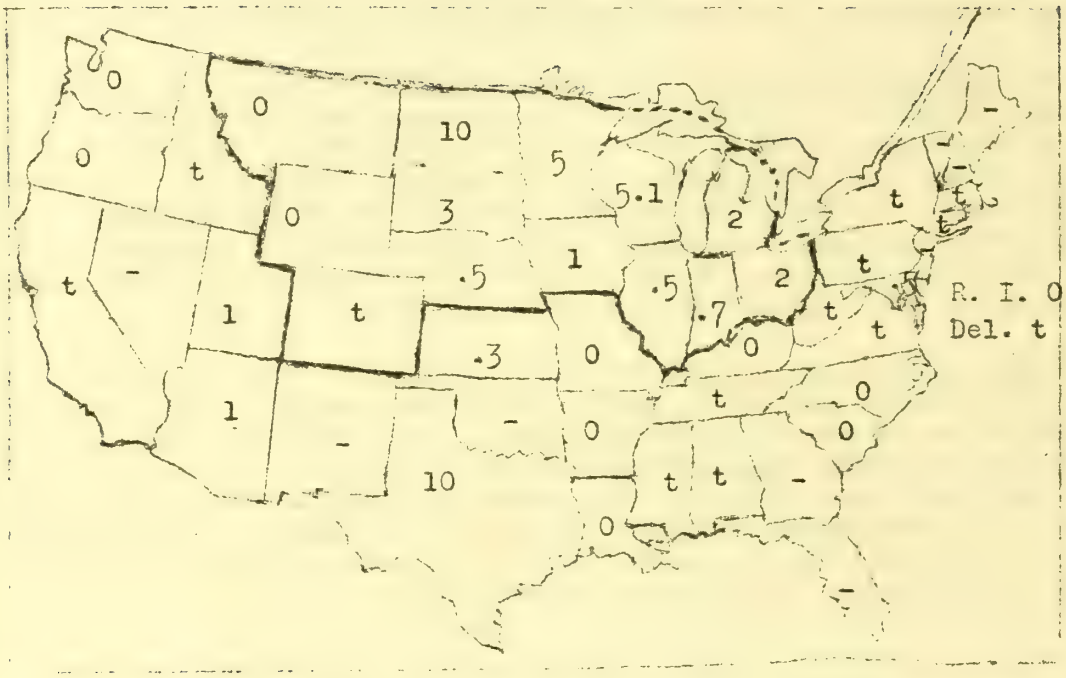

Fig. 21. Estimated average loss from stem rust of wheat, according to collaborators, 1922. Barberry eradication area is shown on this map.

Kentucky: Occurred rather widely over the state, but too late to cause appreciable loss. (Valleau)

Ohio: By June 20 stem rust of wheat near infected barberry bushes had become heavy. In some of these instances the yield will be much reduced. On this date a trace of stem rust of wheat could be found in widely separated sections of Ohio. Farmers were cutting wheat in central Ohio during last two weeks of June. (Cereal Courier 14:(15): 162. 1922)

Indiana: Less than last year. Severe only near barberries. Four bad areas and two minor outbreaks. (Gardner)

Illinois: Infection this year throughout the state, but the total very small. There will probably be very little recordable damage. (Tehon, July 15)

Michigan: Stem rust not as yet common in fields though wheat is in hard dough stage. A few cases found, but these were close to barberry and already in teliospore stage. (Coons, July 12)

Wisconsin: Observed in all sections of winter wheat. Majority of crop matured before much damage was done. Late planted spring wheat was badly damaged. Did not see any fields without stem rust. (Vaughan)

WHEAT - Stem rust

Minnesota: Winter wheat was matured early in July. The amount of infection varied. In most fields it ranged from 5-10%. A few fields were found in Goodhue County in which as many as 25% of the plants were infected, but rust too late to do much damage. In spring wheat considerable rust occurred in many sections of the state. (Sect. Plant Path.)

Iowa: Only a trace on winter wheat, less than I have seen any time during the last seven years. (Melhus, July 15)

Missouri: Very little stem rust was reported in Missouri this year. None was noted in the vicinity of Columbia and only a few spot infections have been found in other places in the state. (Hopkins, July 15)

North Dakota: Rust did severe damage in southeastern portion of the state in an area comprising perhaps one-seventh of the total area of the state. (L. R. Waldron, September 1)

I covered a good part of Cass County and saw a lot of damaged wheat both, Marquis and durum. Latter was rusted badly again this year. The infection seems worse than in the last several years, but the damage may not be as much as most of the wheat is pretty well ripe. All late wheat will be hurt badly. The rust goes west to about Jamestown in damaging amounts, but there is plenty of infection farther west. (J. A. Clark. Cereal Courier 14: 230, August 10, 1922)

Winter wheat matured during first half of July. The amount of stem rust infection varied, but in general was small. There are many fields of Marquis wheat in the southeastern part of the state which are showing 70-100% infection of rust. Wheat harvest is not quite completed in this section. (Wanda Weniger, August 15)

Judging by our county yield figures for both durum and hard wheat in the counties where rust was prevalent, I would say that Cass County is the only one where a 25% loss could have resulted. The southeastern group of counties will average 25% below the state yield, but it was in this district that drouth was also a factor, if not the principal cause. (J. G. Diamond, Agricultural Statistician, Grand Forks, North Dakota, December 2, 1922)

South Dakota: Rust remarkably abundant, but very little damage due to late start. (Evans)

Nebraska: Slight scattered infection, much less than 1921. (Peltier)

Kansas: In a few counties very heavy infection occurred. Traces occurred in practically all of the chief wheat growing counties. (Melchers, July 15)

Montana: Rust did not appear until so late in the season that the crop was beyond the danger point. (Swingle)

Wyoming: Rust has not been found in this state this year. (R. U. Cotter, Cereal Courier 14: 243. August 21, 1922)

Colorado: Quite prevalent in some sections of the spring wheat growing area. It was especially common on Marquis. Where it was late sown it will be damaged to some extent. (Learn, August 1)

Most of the grain of Colorado has been harvested, and we are pleased to report only a small loss from black stem rust. (J. R. Fitzsimmons, Cereal Courier 14: 295. September 20, 1922)

Alberta, Canada: Very little rust was observed on early sown grain. On very late grain a few pustules were present. A little rust was present on heavily irrigated plots at Lethbridge. None could be found on very late seeded wheat at Lacombe. (G. E. Delong in Canadian plant disease survey report, 1922)

Saskatchewan, Canada: Late in the season rust was present at Edmonton on very late wheat but the main crop showed no rust. There was considerable development of rust in southern Saskatchewan, but little injury was done. (W. P. Fraser in Canadian plant disease survey report, 1922)

Manitoba, Canada: Stem rust was very irregular this year throughout the Province. It would be difficult to account for the severity in some parts and absence in other parts. (V. W. Jackson in Canadian plant disease survey report, 1922)

New Brunswick, Canada: It did not appear to be so active or abundant in 1921 and 1922 as in previous seasons, possibly on account of dry summers. (G. E. Cunningham in Canadian plant disease survey report, 1922)

Prince Edward Island, Canada: Prevalent to greater extent than last year and in many cases crop was severely attacked. J. B. McCurry in Canadian plant disease survey report, 1922)

Table 69. Estimated losses from stem rust in barberry eradication area, 1918-1922, inclusive. (Pl. Dis. Bul. Supplements 6, 12, 18 and 24)

State	Percentage stem rust					
	1918	1919	1920	1921	1922	Average
Ohio	.1	1.	t	6.	2.	1.82+
Ind.	t	1.	.1	1.	.7	.56+
Ill.	t	1.	.5	.5	.5	.50+
Iowa	t	8.	7.	10.	.2	5.04+
Mich.	.5	8.	8.	5.	2.	4.70
Wis.	.5	15.	30.	10.	5.1	12.12
Minn.	.1	20.	30.	7.	5.	12.42
N. D.	-	20.	20.	10.	10.	12.00
S. D.	.7	10.	20.	10.	3.	8.74
Nebr.	t	10.	12.	t	.5	4.50+
Mont.	-	*0.	0.	2.5	0.	.50
Wyo.	-	-	t	*	0.	+
Colo.	-	1.	1.	t	t	.40+

WHEAT - Stem rust

Weather relations

A considerable number of collaborators and others mention weather conditions as the reason for the comparatively small amount of damage in 1922 as compared with other years. Although a number of different weather factors are mentioned as being influential, the majority of them seem to agree that in many places at least dry, warm weather held the rust in check and hastened maturity of the grain so that the wheat escaped. In North Dakota it was mentioned that a warm May advanced the wheat crop so that even under favorable conditions for stem rust late in the season, the grain matured before great damage could be done. In Minnesota it was mentioned that cool weather held the disease in check. The following comments from collaborators and others on this subject are given:

West Virginia: Probably checked by dry weather during latter stage of heading. (Giddings and Sherwood)

Minnesota: Moderate infections throughout the Red River Valley, but in general the weather was too cool for the rust to do much damage. (Sect. Plant Path.)

Iowa: Dry weather has effectively checked stem rust. Most of the wheat is harvested and only a trace of damage. (Muncie, July 15)

North Dakota: Another thing that tended to save the crop over a good proportion of the state this year was probably the extremely warm weather for growth during May. If the temperature during May had been normal (it was several degrees above normal) the grain at the time when rust arrived would have been perhaps ten days later in development than it was. (L. R. Waldron, September 1)

South Dakota: The fore part of July was dry and tended to inhibit rust development. If the last of June and first half of July had been moist, I believe it would have been exceedingly destructive. (Evans)

Nebraska: Wheat harvest earliest on record due to dry weather causing early maturity. (Peltier, June 26)

Kansas: Warm weather with lack of rain checked what might have been an epidemic. Infection in a light form was present early and would undoubtedly have spread rapidly had climatic conditions not interfered. (Melchers)

Montana: Weather conditions in most parts of the state have been favorable to the development of rust but it did not appear until so late in the season that the crop was beyond the danger point. (Swingle)

Colorado: Drier weather than usual and temperatures above normal. (Learn)

Arizona: Year unfavorable for development. (Brown)

Washington: On account of the dry season rust has not shown up on grain to any appreciable extent. (Dana, August 15)

Oregon: Long drouth has prevented any development although present throughout the state in small quantities. (Barss)

Alberta, Canada: The weather was very dry in central and northern Alberta during the season and plant diseases were even less than usual. Very little rust was observed on early sown grain. (G. E. Delong in Canadian plant disease survey report, 1922)

Saskatchewan, Canada: But little injury was done by stem rust this season. This was probably due to the dry weather that prevailed in July. (W. P. Fraser in Canadian plant disease survey report, 1922)

Notes from the 1922 rust epidemiology studies -- by E. B. Lambert and E. C. Stakman.

"The stem rust situation was closely watched this year throughout the central Mississippi Valley from Texas to Canada. Overwintering of stem rust was observed in southern Texas and strong circumstantial evidence of overwintering was obtained in northern Texas at Denison. The rust in Texas began to accumulate in April, so that by May 15 it was general throughout the central portion of the state. In June the infection reached ten to forty percent in the northern part of the state, with considerably less rust in the southern areas. Observations at harvest time placed the damage in northern Texas at about ten percent.

"By June 1 general field infection had reached the northern boundaries of Kansas and Missouri and had extended over into the southern portions of Indiana. In Missouri a number of observations were made during June. Although the general infection was light, a peculiar spotted condition of the fields, with regard to the presence of stem rust, was observed in several localities. Spots ranging from ten to thirty feet in diameter were found to be heavily infected, while the surrounding fields were only slightly rusted. This condition was probably due to overwintering urediniospores or to wind-blown spore.

"On June 1 rust had already appeared on cereals and grasses near barberries throughout practically the entire barberry eradication areas, with the exception of western North and South Dakota, Wyoming, and Montana. For example, at Northfield, Minnesota, on June 6, rust was observed to have spread for at least a mile and a half from barberries, traceable directly to aeciospore infection. In this location, where a careful study was made, there was twenty-five to one hundred percent infection on all of the plants at three-fourths of a mile distant from the bushes. The spread of rust was later definitely traced from this planting to a distance of three miles.

"Stem rust was first reported spreading from barberries to grains or grasses on the following dates: Nebraska, May 22; Minnesota, May 26; Ohio, May 27; Colorado, May 28; Wisconsin, June 1; North Dakota, June 2; Michigan, June 3; Illinois, June 8; New York, June 10; and Montana, June 23. Listing these states in the same order, rust was first reported from barberries as follows: Nebraska, June 2: Minnesota, June 17; Ohio, June 30; Colorado, June 15; Wisconsin, June 29; North Dakota, June 13; Illinois, June 8; New York, Jul 6; and Montana, June 30.

"In the spring wheat area there was a general epidemic of stem rust this year. However, severe damage was confined to small local areas, owing to the fact that the rust did not become heavy until the grain was about ready to harvest. While this year's evidence indicates that the inoculum from the barberries alone could have produced the entire eopdemic, it is also possible tha southern blown spores may have contributed a share of the late infection.

"All of the work which was done early in the season, however, indicated that the epidemic of rust which occurred in the north came principally from barberries. It was quite significant that the number of urediniospores of black stem rust decreased rather rapidly as the distance from known areas of rust infection increased. For instance, early in the spring an area was found near Denison, Texas, in which there was fairly heavy rust. By means of exposing spore traps on aeroplanes it was found that the number of spores near the rusted area was rather large but that the number diminished rather rapidly as the distance from this area increased. While viable urediniospores can be found in the air, and while some of them undoubtedly are carried long distances, it would appear that the process of spread of the rust from the south to the north by means of wind-blown urediniospores probably would be so slow as to make it rather difficult for an epidemic to develop in the north if the barberries were eradicated."

Barberry eradication

Dr. F. E. Kempton (2) reports as follows concerning the barberry eradication campaign:

"In the barberry eradication campaign conducted co-operatively for five years by U. S. Department of Agriculture and 13 north-central states, marked progress has been made. During 1922, the survey covered 200 counties. This includes 16 counties in Minnesota and one in Iowa surveyed on State funds. In these counties, 186,672 bushes were located on 5,278 properties, and 696,517 bushes were removed from 5,799 properties. Of 275 counties previously surveyed, 201 were completely resurveyed in 1922, and 84,142 sprouts were found and removed.

"During the five years, 1918-1922, practically all cities and villages of the 13 States have been covered once and resurveyed in part, and 475 counties have been completely covered. This includes 40 counties surveyed on funds furnished by States. In the 5 years, 2,066,541 bushes have been found in cities and villages and 3,740,102 on farms, making a total of 5,806,643 bushes found, of which 5,140,343 have been removed."

The problem of the sprouting up of new plants from portions of roots left in the ground is proving to be a very important one in the campaign. Regarding this Kempton states (Cereal Courier 14: 403, Dec. 31, 1922):

"A complete resurvey has been made in 201 of the 276 counties surveyed in previous years, and a resurvey also has been made in all cities and towns covered in the original farm-to-farm survey. In this resurvey, 88,740 sprouts and thousands of seedlings were found and removed during the past year. It has become evident that several resurveys will be necessary. If the entire root system is not removed when barberry bushes are dug, sprouts may grow even from small bits of the roots which are left in the soil. To go back after a bush has been dug and find all of these sprouts is difficult and expensive. Furthermore, it is almost impossible to remove all of the

roots which have entwined with the roots of trees or which have grown into the crevices between rocks."

N. F. Thompson (4,5) has conducted experiments with the use of chemicals for killing barberry bushes. About 40 different chemicals have been tried and two of them, rock salt and sodium arsenite have given uniformly good results, being available, cheap and effective. About ten pounds of rock salt is piled around the base of the barberry bush at any time of the year and complete death of the plant is practically certain.

Many more escaped barberry bushes have been found than were expected when the campaign was started. Regarding this question, Kempton states (Cereal Courier 14: 403. Dec. 31, 1922).

"The spread of escaped barberries to open woodlands, fence rows, rocky ledges, brushy pastures, and stream banks has become the most serious problem of the campaign. During the past year, 133,365 escaped bushes have been found on 830 properties. The great number of these were in the States of Michigan, Ohio, Illinois, Wisconsin, Minnesota, and Iowa. During the entire campaign, 3,760,351 barberries were found on farms, only 331,801 of which were cultivated while 3,428,550 have been escaped bushes. These areas are being carefully mapped in order to facilitate the complete eradication of seedlings and sprouts. All bushes in representative areas in Iowa, Wisconsin, Illinois, Michigan, and Ohio have been treated either with rock salt or sodium arsenite as trials of that method of eradicating escaped barberries."

Varietal susceptibility

J. Allen Clark reports (Cereal Courier 14: 41. March 31, 1922):

"Since the discovery of rust resistance in Kanred and Kota these high quality varieties of common wheat have been used as rust-resistant parents, which has made it unnecessary to rely upon the durum wheats for obtaining rust resistance..... An extensive series of hybrids made between Marquis and Kanred in 1917 and 1918, with the object of producing a spring wheat with the qualities of Marquis and the rust resistance of Kanred, has produced promising material.....

"Crosses made in 1919 and 1920, between the rust-resistant Kota, and Marquis and Ruby, offer unusually good possibilities for obtaining the desired types..... Several other crosses for rust resistance have been made, including the cross of Kanred and Kota, which combines the two varieties that are resistant to many of the forms of stem rust. An attempt is being made to develop, synthetically, strains of spring wheat resistant to all biologic forms of stem rust. (Cooperative wheat breeding experiments between U. S. Office of Cereal Investigations and the Minnesota Agricultural Experiment Station)

O. S. Aamodt (1) in his paper at the Boston meeting reports further concerning the work of crossing Kanred and Marquis.

Melchers and Parker(3) in their recent bulletin have reported that out of the 100 varieties and strains of winter wheat tested, all of them were found to

e susceptible to stem rust except Kanred and two very similar pure-line selec-ions, P1066 and P1068. Another pure-line strain, Kansas No. 2390, gave evidence f being partially resistant. Several varieties of spring wheat proved rust re-istant under the conditions of their experiments, though the Black Persian was he only spring wheat variety of the common or bread wheat group which was found o be resistant. Of the varieties of durum or macaroni wheat, Beloturka (C. I. o. 1513), Iumillo (C. I. No. 1736), Kubanka (C. I. 2094), Monad (D-1), and Pentad D-5) showed definite signs of resistance to stem rust. A hybrid of Iumillo x reston, resembling the durum parent, also was found to be rust resistant. All f the strains of emmer and einkorn grown gave some evidence of resistance.

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Leaf rust caused by Puccinia triticina Eriks.

Regarding the distribution and severity of leaf rust in 1922, Dr. E. B. Mains, who has been investigating this disease with the Indiana Experiment Station and the U. S. Office of Cereal Investigations reports as follows:

WHEAT - Leaf rust

"The leaf rust of wheat, Puccinia triticina, has been unusually severe this year throughout most of the eastern United States. The rust has been heavier over a wider area than in any year since investigations were started in 1918. In addition to the territory covered with heavy development of leaf rust last year, which comprised North Carolina and Tennessee to Kansas northward, the Southern states have suffered considerably, especially Georgia and South Carolina.

"Observations since 1918 would indicate that the territory included in a strip running from Maryland and North Carolina westward through southern Ohio, Indiana, Kentucky, Tennessee and Kansas, is apparently rather uniformly subject to heavy annual epidemics of leaf rust, the territory to both the south and north escaping some years with only a moderate or light epidemic."

A summary of the reports of Plant Disease Survey collaborators shows that leaf rust was especially severe in 1922. It was rated as more prevalent than in 1921 in New York, Virginia, West Virginia, South Carolina, Georgia, Indiana, Illinois, Kansas, and Minnesota, and it will be recalled that 1921 was a bad year for leaf rust throughout central eastern United States. The following states list leaf rust as being the most important disease of wheat in 1922: New York, Delaware, Maryland, Virginia, West Virginia, South Carolina, Indiana, Illinois, Tennessee, Mississippi, Oklahoma, and Arkansas. The states of Pennsylvania, Georgia, Ohio, Wisconsin, and North Dakota report leaf rust as being the second disease in importance.

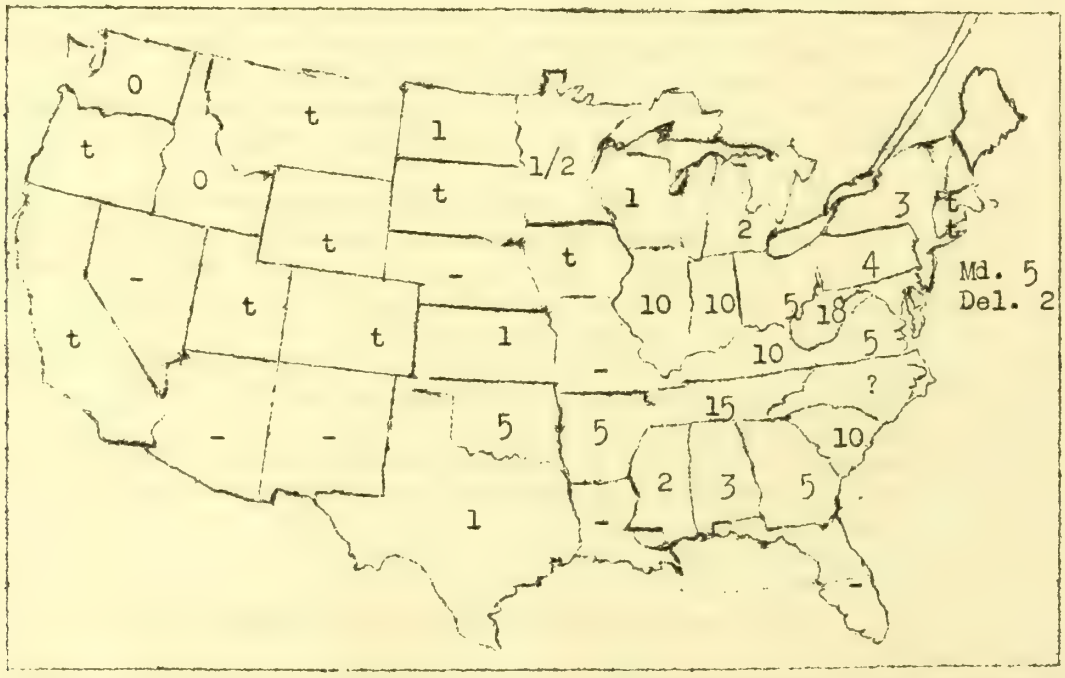

Fig. 22. Estimated losses from leaf rust of wheat, 1922.

The accompanying map shows the estimated reduction in yield from leaf rust

according to collaborators. An examination of this map will show that the greatest losses occurred in the belt of states mentioned by Mains and in the Southern States. Dr. Mains has given considerable attention to the matter of loss, regarding which he writes as follows:

"It is of course difficult to accurately estimate the loss due to the leaf rust of wheat on account of the lack of a basis for comparison. In northern Georgia and South Carolina a number of farmers were so alarmed by the rapid and heavy development of the rust before heading time that they made inquiries as to the value of rusted wheat for hay or pasturage and as to the advisability of plowing the crop under. In all cases they were advised against such measures. When visited about May 9, the wheat in this region was very heavily rusted, especially the variety generally grown, and known as Tennessee Purple Straw. The leaves had been prematurely killed, but the wheat had headed fairly well. Mr. R. P. Bledsoe stated that the rust in the region of Experiment, became severe about March 1st, when the wheat was beginning to shoot. He estimated that the loss was likely to be 50%. He later stated that the yield on Purple Straw this year at Experiment was 14 bushels, while on similar land last year, when very little rust developed, it was 30 bushels. At Jefferson, Georgia, County Agent Hill Hosch stated that the rust became bad about March 1, when the wheat was about 1 foot high. He estimated that the loss would run from 25% in some fields up to as high as 100% in the heavier rusted. He expressed much concern over the situation since he stated that more wheat had been planted in that county this year than in the past six together. It is evident that some years in this region the leaf rust of wheat is an important factor in wheat growing. Apparently there is a desire throughout the South for better systems of farming involving the adoption of crop rotation in which the land will have crops on it in the winter which will bind the soil and prevent washing, and wheat is most to be desired for this purpose on account of the value of the crop. One of the principal obstacles apparently is the loss due to rust.

"Throughout Virginia, Tennessee, and Kentucky, the leaf rust of wheat apparently started somewhat later than last year, yet the greater severity will probably result in as much loss as was experienced in those states in 1921. In Indiana and Illinois the leaf rust of wheat was more uniformly severe over the entire state than last year, only small areas as around Lafayette, Indiana, where drought prevailed for three or four weeks before harvest showing moderate or light infestations of the disease. The loss consequently for these states as a whole is likely to run higher and the disappointing yields which have been reported from southern Indiana are probably due in large part to the general prevalence and severity of the disease there this spring. A few fields in southern Indiana have been reported by Dr. Charles Gregory as being practically a complete loss where leaf rust became heavy early when the wheat was about a foot high. The loss for the southern part of Indiana, as estimated by members of both the Soils and Crops and Botany Departments, was placed at about 20%, while for the state as a whole, it was considered as averaging in the neighborhood of 10%. Dr. Gregory has arrived at similar conclusions by taking the dif-

ference shown between the May estimate in the Indiana Crop Reporter and the actual yield in August and dividing this among the different factors producing reduction in yield.

"In greenhouse experiments, losses as high as 40% have been obtained under conditions of heavy infection starting about heading time. Even heavier losses have been obtained when the wheat plant is rusted earlier. It may also be stated that the yield of rusted plants when taken by themselves does not create an impression of heavy loss, the grain being about as plump as the non-rusted, and of fairly good number, but the number is decidedly less than the non-rusted. I believe that in the absence of complete loss or noticeable effect on the grain, the lack of a non-rusted basis for comparison is largely responsible for the opinion, often expressed, that leaf rust does little or no damage. Part, at least, of the decrease in yield attributed to weather probably is due to this rust."

Attention is called particularly to the statement by Mains that as high as 40% reduction in yield has been obtained by experimentally infecting plants with leaf rust and that the loss is not evidenced by shriveled grains but by a reduction in the number of kernels. It is thought that the production of sound grains in wheat heavily infested with leaf rust has led to the belief that the disease was not of a serious nature.

Varietal susceptibility

Mains reports as follows concerning the susceptibility of varieties:

"One thing very noticeable this year has been the increase in susceptibility of a number of the varieties which in previous years had shown high resistance, many varieties being only moderately resistant, where before they had shown a high resistance. Thus several strains of Turkey, Beloglina, Kanred and some of the spelts and durums showed higher percentages of leaf rust this year than hitherto, the presence of hypersensitiveness in most cases indicating that there was not a complete loss of the resistant character. Otherwise most of the strains reported as resistant last year have shown high resistance in one or more plantings. In addition a number of other varieties have been observed showing resistance. These include a durum in the variety nursery of R. P. Bledsoe, at Experiment, Georgia, several Italian wheats grown by Prof. Essary at Knoxville, Tennessee, and a number of spring wheats in the nursery of J. G. Dickson at Madison, Wisconsin, especially Acme, Huguenot, Medeah, Iumillio, Saragolla, Kubanka, Black Don, Vernal Emmer, Einkorn, and some 80-100 unnamed selections mostly Algerian.

"Although Kanred has not been quite as highly resistant this year, yet Dr. Leighty and myself have been able to make some very promising selections in the F_2 generation of hybrids made by Dr. Leighty between Kanred and some 24 of the principal soft winter varieties. About 800 such selections have been made and many of them show considerable promise of combining the resistance of Kanred with the desirable characters of a soft or semi-hard eastern variety.

"All of the work is complicated by the presence of strains in the leaf rust resulting in certain varieties showing considerable difference in susceptibility in two different localities, some being immune at one place and rusted 70-80% at another, as for instance, Malakoff C. I. 4898. This, of course considerably complicates the work of controlling leaf rust with resistant varieties. Twelve of these strains have been differentiated in the greenhouse and 31 varieties have been found to have this differential character, resistant to some and susceptible to others. No variety has been found which is immune in the seedling stage to all of these strains, but also no culture of leaf rust has been sown to which some of these varieties are not either immune or resistant so that there is hope of obtaining a generally resistant variety by hybridization."

Melchers and Parker (3) made observations at Manhattan, Kansas for the five-year period from 1915-1919, inclusive, showing that the three pure lines of Crimean wheat, Kanred, P1066, and P1068, are remarkably resistant to leaf rust as it occurs in Kansas. They state that the resistance has been manifested also in experimental field sowings in a number of other states and in New South Wales, Australia. They do not claim, however, that the resistance of these varieties will be absolute under all conditions or in the presence of all biologic strains of leaf rust.

Collaborators in New York and Oklahoma report resistance in Kanred; Giddings, in West Virginia, noted that Gladden wheat is especially susceptible; Weniger, in South Dakota, reports common wheats as generally not severely infected, but Kota and some durums are quite susceptible; Vaughan, in Wisconsin, reports as follows, under date of July 1:

"Much more noticeable on beardless winter wheat than bearded selection at Marshfield and Ashland Branch Experiment Stations. Wisconsin #408, which has been disseminated by the Agronomy Department, shows a high degree of leaf rust resistance when compared with all other winter wheat selections grown."

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Stripe rust caused by Puccinia glumarum (Schm.) Erikss. & Henn.

Collaborators in Montana and California reported stripe rust as present in 1922, but in slight amounts. From California, W. W. Mackie reported:

"Stripe rust was very scarce this year. In the grass garden at Berkeley stripe rust over-wintered and over-summered, causing an increased number of hosts to show attack. Some of these hosts were wild grasses outside the plots."

WHEAT - Stripe Rust

The Office of Cereal Investigations has contributed the following statement and map (fig. 23) taken from a recent report on the stripe rust situation by C. W. Gungerford of Idaho:

Fig. 23. Present known distribution of stripe rust (Puccinia glumarum) in the United States.

"Practically no stripe rust developed in the field during the entire season. Indeed, it has been difficult to keep cultures growing in the greenhouse due to the extremely dry and hot weather. Information secured from various parts of the Pacific Northwest and from California show that the same condition existed over this entire region. Professor Owens at Corvallis, Oregon states in a recent letter: 'I have been unable to find any stripe rust this fall. It is the first time in years that this has been the case.' Mr. D. E. Stephens of Moro, Oregon, writes: 'Although I made diligent search for stripe rust on our grains this year, I was unable to find a single specimen. This is the first time in years that we have not had more or less stripe rust.'

"Owing to climatic conditions, only two collections of stripe rust were made in Idaho this year, one at St. Anthony on Hordeum jubatum and one at Moscow in the grass garden late in October upon Hordeum nodosum. In 1921 stripe rust was very plentiful throughout the summer months.

"A study of meteorological data for the last few years throws some light on this question. The total precipitation during the two months of September and October in 1920 was four and eighty-nine hundredths inches. The precipitation during September and October, 1921, was only two and ninety-nine hundredths inches. The precipitation during the months of September and October, 1914, was four and eight hundredths inches. The normal for these two months is only two and eighty-nine hundredths inches. The year 1915 following the wet fall of 1914 was the year stripe rust was discovered in the United States, and the rust was more plentiful according to all reports that year than any other year since, with the possible exception of 1921.

"It has been conclusively shown that stripe rust can overwinter at Moscow, Idaho, as mycelium in the tissues of various hosts. The critical time for the parasite seems to be in the late summer and early fall months. If the rust oversummers in sufficient amounts and congenial hosts are present and the weather conditions are such that the rust may develop and infect these hosts early in the fall, there will be enough overwintering of the fungus to insure a spread of the rust in the early spring. Infection later in the summer will doubtless depend to a great extent on the weather conditions in the early summer.

"During the last year it has been shown that stripe rust may overwinter at Moscow, Idaho. The rust developed on Hordeum nodosum

plants in the grass nursery on April 3, 1922, and the indications were that infection had taken place in the fall and had remained dormant throughout the winter. Snow covered these plants from December until the middle of March. Several uredinia were found on an old leaf of a seedling of the above host on that date. The infection had very evidently spread from an old scar on the leaf where a sorus had been the fall before. On April 15, a number of seedlings of this host were found infected.

"Several new hosts for stripe rust have been found during the last year. In all there are now about sixty grass hosts in addition to wheat, barley, spelt and emmer which are known to be hosts for the rust."

Recent literature

Armstrong, S. F. The Mendelian inheritance of susceptibility and resistance to yellow rust (Puccinia glumarum Erikss. et Henn.) in wheat. Jour. Agr. Sci. 12: 57-96. Feb. 1922.

Scab caused by Gibberella saubinetii (Mont.) Sacc.

During 1922 scab occurred, to some extent at least, in all of the wheat-growing states east of the 100th meridian. It was most prevalent, however, in

Fig. 24. Estimated percentages of loss from scab in the United States during 1922, according to collaborators.

the states along the Atlantic Seaboard from Virginia northward to New York, and in West Virginia and parts of Ohio, Kentucky, and Tennessee. In the eastern part of this general region the disease was probably even more severe than in 1919, when scab caused such severe losses throughout the eastern wheat area. From western

WHEAT - Scab

Ohio, through Indiana and westward through the remainder of the winter wheat section and also in the spring wheat areas, the disease was less prevalent than last year and caused only slight amounts of damage. The accompanying map (fig. 24) shows the estimated percentages of loss in the various states.

Some of the more significant comments of collaborators on distribution and severity of scab are as follows:

New York: Very much more than last year. (Kirby)

New Jersey: No doubt more severe this spring. (Poole)

Pennsylvania: Has been serious this year. Reports indicate losses as high as 10-12% of the crops in some fields. Generally the most important trouble of wheat this year. (Thurston)

Maryland: More prevalent than last year. Found in all fields and causing considerable loss in many of them. One field has been found with 80% of the heads infected. (Temple)

West Virginia: More than last year; of considerable importance. (Giddings)

Kentucky: Much worse than last year. The wheat scab organism appeared to be an important factor in the broken straw disease of wheat which was very destructive in Kentucky this year. (Valleau)

Ohio: Scab attack on heads of wheat was in general in Ohio during season. Counts of percentages not made in large number, but estimated infections ranged as high as 20% with 3-5% loss in yield. (Thomas)

Indiana: Less, rarely observed. (Jackson and Mains)

Illinois: Apparently not so prevalent nor so injurious as in the past years. (Tehon)

Wisconsin: Scattered late infections. (Dickson)
Less, of minor importance. (Vaughan)

Minnesota: Less, very little observed. Only trace damage. (Sec. Plant Path.)

Missouri: Much less severe this season than last. (Hopkins)

North Dakota: Less, not severe either as seedling or head blight. The disease has been markedly absent in 1922, and was only slightly present in 1921. The severe epidemic in 1919 was followed in 1920 by moderate severity. (Weniger)

South Dakota: Less than last year, did some damage which was slight, however. (Evans)

WHEAT - Scab

Dates of earliest appearance, according to collaborators:

June 5 - Illinois	June 17 - Virginia	June 24 - Minnesota
" 7 - Missouri	" 19 - New York	" 30 - Wisconsin
" 12 - Maryland	" Mid.- Ohio	" - - Delaware, South Dakota.

Weather relations in the winter wheat area.

During the last week of May and the first half of June, flowering of wheat was general in New Jersey, Delaware, Maryland, southern Pennsylvania, western Virginia, West Virginia, Kentucky, Ohio, Indiana, Illinois, Missouri, Iowa, and westward. The weather conditions during this same period were favorable for flower infection with the scab organism for the eastern part of this area, but unfavorable from central Ohio and Kentucky westward. The month of June, especially the first part of it, was extremely wet in the East, but dry in the West, according to the Weather Bureau.

The accompanying map (fig. 25) shows the areas in the eastern wheat sections where four inches or more of rainfall was reported during June. Concerning June precipitation, the Weather Bureau issues the following statement (Monthly Weather Review 50[6]: 323. June 1922):

> "In the main, precipitation was frequent and unusually heavy over most eastern districts, in fact portions of New York and New England had more rain than ever previously recorded in June. On the other hand, the month was distinctly dry in the great central valleys and portions of the far Northwest. In portions of Illinois, Indiana, Iowa, and locally adjacent states, the total fall for the month was less than 1 inch, in some instances less than half an inch, while at Chicago, Ill., it was but one-tenth of an inch, the least recorded in June for over 50 years, and similar conditions existed at other points in the Middle West."

Statements from individual states in this area concerning the June weather are as follows (Climatological Data 9[6]: June 1922):

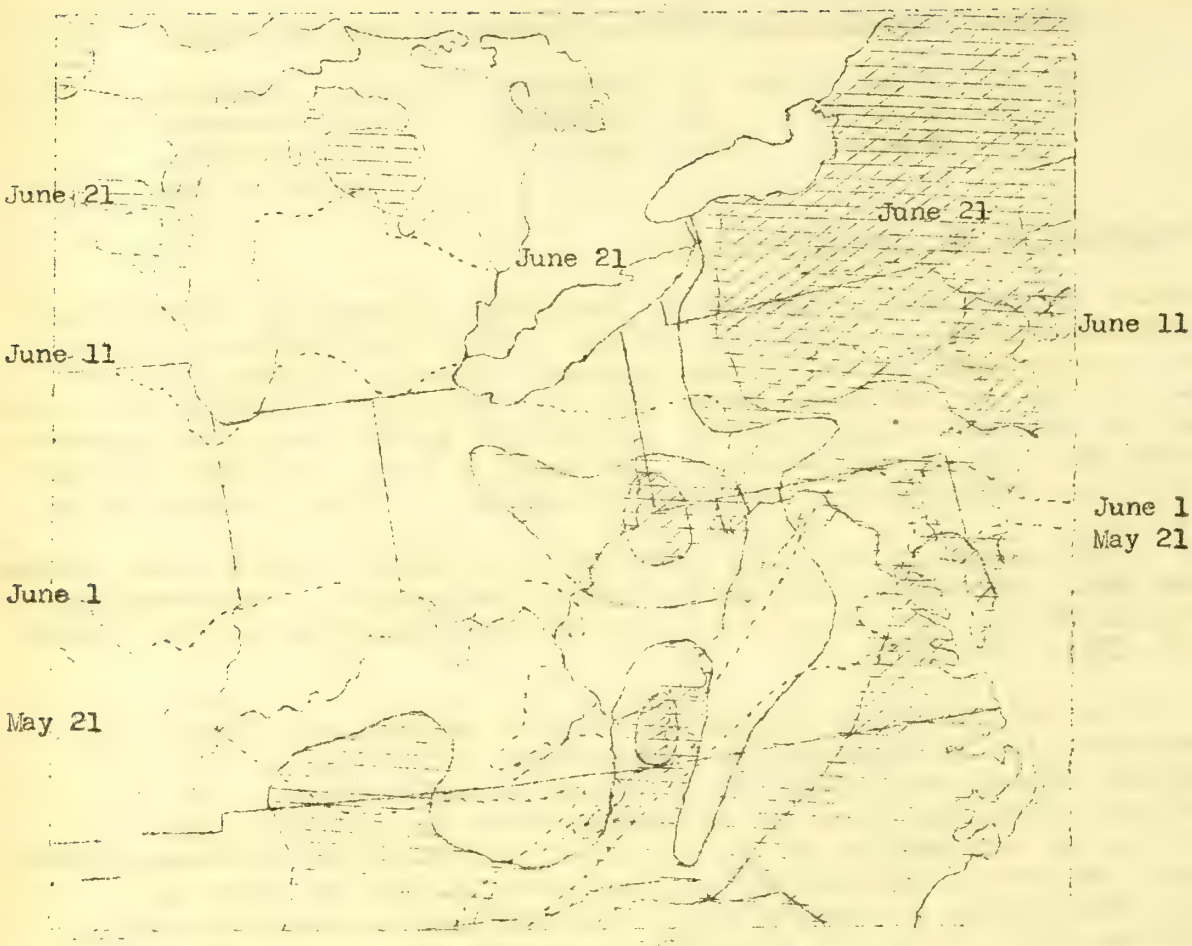
New York: "A moderate excess in temperature, deficient sunshine, an unusual number of severe local storms, and the heaviest rainfall on record, not only for June but for all months, were the outstanding features of the month."

New Jersey: "The average warmth of June, 1922, in New Jersey has been exceeded but three times, in 1889, in 1895, and in 1892, in the past 37 years. The other weather feature of the month was the persistent and copious rain which fell very generally on the first six days."

Pennsylvania: "June was a comparatively rainy month for the greater part of the state, and wet weather interfered at times with cultivation and harvesting, especially in the eastern and northeastern counties."

Delaware-Maryland: "June was warm and wet with sunshine below normal. Wheat, rye, peas, strawberries and hay were somewhat damaged by the warm wet weather of the first decade."

WHEAT - Scab



4-6 inches rainfall Over 6 inches rainfall
- - - - - Dates when flowering of winter wheat is general.

West Virginia: "June was considerably warmer and wetter than usual."

Ohio: "Temperature for the month averaged above normal and the precipitatio averaged below normal, but the deficiency was not general over the stat quite a number of stations in central and southeastern counties showing an excess."

The following comments from collaborators indicate that scab was worst in the sections of the eastern states where the June precipitation was heaviest (See fig. 25).

New York: Over all parts of the state surveyed. (Kirby)

Pennsylvania: The map submitted by the Department of Botany shows greates occurrence in the southeastern quarter of the state.

Maryland: More prevalent on Coastal Plain. (Temple & Jehle)

Virginia: Especially prevalent in southwest. Moderate injury reported from northern counties. (Fromme)

West Virginia: General, but worse in valleys. (Giddings & Sherwood)

Kentucky: Especially bad in Logan County, but scattered over all of the state. (Valleau) Logan County is in south central portion of the state.

Ohio: Worse in southern portion of state.

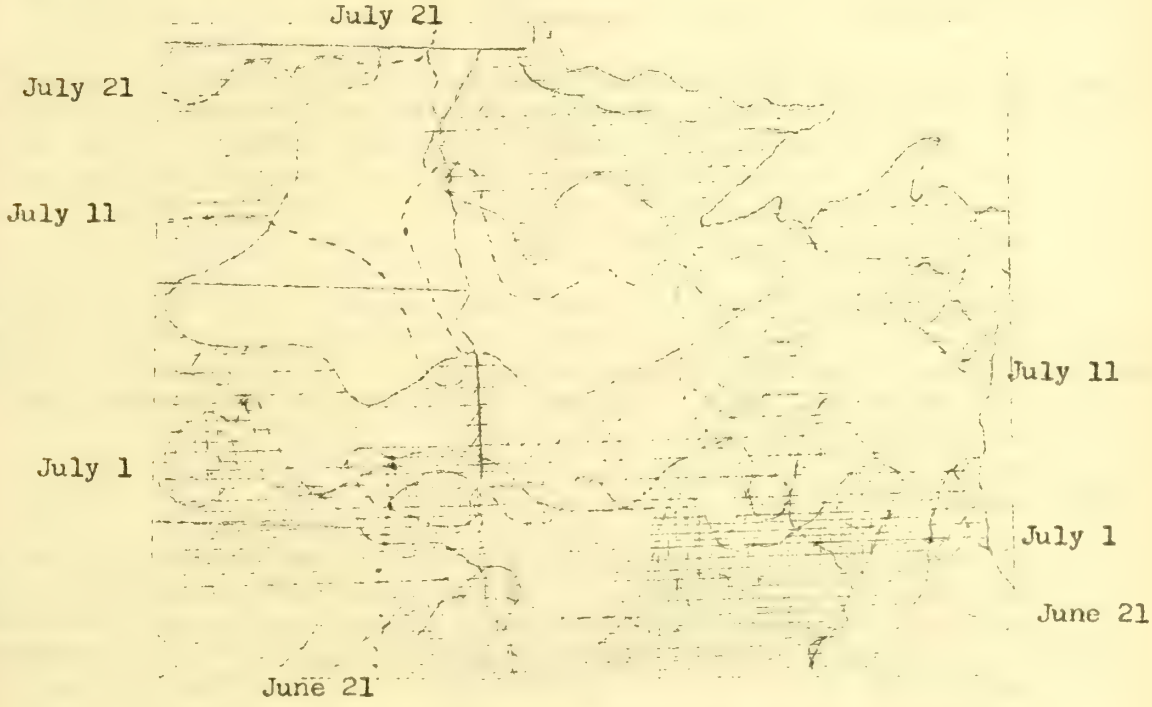


Fig. 26. July precipitation in spring wheat area.

Weather relations in spring wheat area.

The flowering of spring wheat normally is general in northern Illinois, Iowa, Nebraska, and southern Wisconsin, during the last two decades of June and in Minnesota and North and South Dakota flowering is usually general during the first two decades of July.

The June rainfall for 1922 was deficient in Illinois, Iowa and Nebraska region, with a result that only slight infection of scab occurred. The July precipitation for Minnesota and the Dakotas was also much below normal, with the result that conditions at flowering time were not favorable for infection. The following statements from the United States Weather Bureau (Climatological Data 9&7: June & July, 1922) give an idea of the weather conditions in the spring wheat area:

Illinois, June: "June was moderately warm and very dry."

Iowa, June: "June was considerably warmer than normal and unusually dry."

Nebraska, June: "The weather conditions for June 1922 as shown by the monthly state averages, were warm and dry with an excess of sunshine."

Minnesota, July: "The special features of the month's weather were the unusual coolness and drought over much the larger portion of the state."

North Dakota, July: "The mean temperature for the state was 65.6° or 1.9° below normal. The average precipitation for the state was 2.43 inches or 0.18 inches below the normal."

South Dakota, July: "The average temperature during July was considerably below normal. The average precipitation for the state was considerably in excess of normal. Over most of the northeastern quarter, however, there was a decided deficiency, and in the extreme northern counties of the northwestern quarter the deficiency was considerable. At a few southeastern stations there was a deficiency."

The accompanying map (Fig. 26) shows the distribution of the rainfall in the spring wheat states for July, and also indicates the time of flowering of wheat in various parts of the area. This map, together with thepreceding statements regarding the weather conditions, suggests an explanation for the scarcity of scab in spring wheat during the year.

Recent literature

Dickson, James G. The influence of soil temperature and moisture on the development of seedling blight of wheat and corn caused by Gibberella saubinetii (Mont.) Sacc. (Abstract) Phytopath. 13: 50. Jan. 1923.

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MacInnes, Jean. The growth of the wheat scab organism in its relation to hydrogen-ion concentration. Phytopath. 12: 290-294. June 1922.

Wineland, Grace O. The production in culture of the ascigerous stage of Fusarium moniliforme. (Abstract) Phytopath. 13: 51. Jan. 1923.

Take-all caused by Ophiobolus cariceti (Berk. & Br.) Sacc.

In a paper by Fitzpatrick, Thomas and Kirby (1), published during 1922, the authors conclude that the Ophiobolus causing take-all of wheat in New York is the same Ophiobolus that occurs on wheat in England, France, Italy, and Japan, and that the Australian fungus is undoubtedly also the same. After comparing descriptions and material from a considerable number of sources they conclude that the correct name for the fungus is Ophiobolus cariceti (Berk. & Br.) Sacc.

During 1922 the disease was found occurring again in New York over even a somewhat larger territory than in 1921. However, although it was found in a higher percentage of fields, the disease was not so severe as during the previous year and the loss was not so great, being estimated at only about 1%. It was further esti-

mated that take-all occurred in about 64% of the wheat fields of New York state, most of which are in western New York where the disease is most prevalent. Kirby reports that Forward, Dawson, and Red Wave showed the greatest resistance of the varieties observed. The following are comments of the New York collaborators concerning the 1922 situation:

"The killing during this wet year was less than last year but the diseased plants were not as badly dwarfed and many infected plants showed almost no symptoms. In one or two wheat fields O. cariceti was found on nearly every plant but the number of dead plants was very low. It was observed that most of the plants had one or two healthy culms with normal heads but that the other culms were dwarfed and dead and were infected with O. cariceti.

County	Total no. fields surveyed	No. of fields with take-all	Average percent killed by take-all
Cayuga	59	57	1.3
Erie	1	1	.2
Genesee	38	11	t
Monroe	1	1	t
Orleans	7	1	t
Seneca	3	3	4.3
Tompkins	7	3	t
Wayne	8	8	1
Total	124	85	True Av. .8

(Kirby)"

"Last year Kirby and Thomas were of the opinion that manure containing contaminated straw was largely responsible for the persistence of the disease in wheat lands, but now after making a more careful examination of affected areas we are of the opinion that quack (Agropyron repens) which is somewhat resistant to the disease harbors the parasite from one wheat season until the next. We were able to find affected quack in nearly all of the take-all areas." (Barrus, July 7).

Reports of the occurrence of take-all in the field have also been received from the other three states reporting the disease last year. In Indiana a very slight amount was found on one farm in Knox County by H. S. Jackson. In Arkansas it was found again, in one field only, near Fayetteville where it caused a severe root rot and was affecting about 75% of the plants in the field. In Oregon, Barss reports that it was present in the Willamette Valley but was so scarce this year as to escape notice. The greatest damage found was 1% in one field near Hillsboro.

At the Wisconsin Experiment Station, H. H. McKinney conducted some experiments on the relation of soil temperatures to infection. Regarding the work, he reports as follows: (Cereal Courier 14: 23-25. Feb. 28, 1922)

"With the assistance of Mr. R. J. Davis, graduate student in

Nebraska, June: "The weather conditions for June 1922 as shown by the monthly state averages, were warm and dry with an excess of sunshine."

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"With the assistance of Mr. R. J. Davis, graduate student in

plant pathology, a preliminary soil-temperature experiment with Ophiobolus graminis has been carried on in the 'Wisconsin tanks.' Soil was inoculated with pure culture of the organism grown from a single ascospore isolated from a diseased wheat plant collected near Corvallis, Oregon. This experiment shows that at favorable soil temperatures, the parasite produces a severe seedling blight and often kills the plant within 14 days after sowing. The greatest injury occurred in soil held at temperatures near 22° and 24°C. The characteristic blackening of the base of the seedling and the 'plate' of the mycelium are strikingly evident. Badly infected seedlings turn yellow just below the tip of the leaves and gradually the whole plant turns yellow and then a bronze color. Severe root rotting also takes place at favorable temperatures.

"The seedling blight symptoms produced by Ophiobolus graminis are strikingly different from those produced by Helminthosporium sativum and Gibberella saubinetii as well as from the first symptoms of the false take-all. (rosette)."

References

(Cited):

(1) Fitzpatrick, H. M., H. E. Thomas, and R. S. Kirby. The Ophiobolus causing take-all of wheat. Mycologia 14: 30-37. 1922.

(2) Kirby, R. S. The take-all disease of cereals and grasses. Phytopath. 12: 66-88. Feb. 1922.

(Not cited):

Kirby, R. S. Heterothallism in Ophiobolus cariceti. (Abstract) Phytopath. 13: 35. Jan. 1923.

Rosette, cause undetermined

In the field, this disease was reported only from Indiana and Illinois, where it has been known to occur for several years. It was found on one additional farm in Laporte County, Indiana, by J. B. Kendrick, and in Illinois it was found scattered in a number of places on Red Cross wheat.

Very important progress on the study of the cause of this disease has been made during the past year by McKinney, Eckerson and Webb (1). They find intracellular bodies associated with the diseased tissues and report that in some stages the rosette disease strongly resembles mosaic. (See also report by Peltier on wheat mosaic, page 215).

Recent literature

(Cited):

(1) McKinney, H. H., Sophia H. Eckerson, and R. W. Webb. Intracellular bodies associated with the rosette disease of wheat. (Abstract) Phyropath. 13: Jan. 1923.

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McKinney, H. H., and Larrimer, W. H. Symptoms of wheat rosette compared with those produced by certain insects. U. S. Depart. Agr. Bul. 1137: 1-8. Pl. 1-4. March 1923.

McKinney, H. H. Investigations of the rosette disease of wheat and its control. Jour. Agr. Res. 23: 771-800. Mar. 1922.

Stevens, F. L. The Helminthosporium foot-rot of wheat, with observations on the morphology of Helminthosporium and on the occurrence of saltation in the genus. Ill. Dept. Reg. Educ. Div. Nat. Hist. Survey Bul. 14: 77-186. 1-23. June 1922.

Helminthosporium blight caused by Helminthosporium sativum P.K. &B. (See also black point, page 214)

This fungus was the cause of seedling blight, leaf spot, and head blight in a number of states, particularly those in the spring wheat section. In Wisconsin Vaughan reports it as causing a trace of damage as a seedling blight and leaf spot all over the state on spring wheat. In Minnesota the disease was also reported as present throughout the state and causing considerable injury in some areas. It occurred in about the same amounts as usual there and took the form of leaf and head injury. In North Dakota, Weniger reports it as about as prevalent as usual and not very important as a seedling blight, but causing considerable damage as a head and kernel disease. One half percent reduction in yield for the state is estimated and some fields were found with 50% of the heads affected. The statement is made that this is a disease of durum wheat particularly, and more severe on red durums than on amber. It is confined to the Red River Valley conditions of heavier rainfall and soils. From Kansas and Idaho, this disease is reported as causing slight damage as a seedling blight, and from Saskatchewan the fungus was reported as common on stems and heads of durum wheat.

Recent literature - See rosette above.

Other foot and root rots

Aside from the take-all, rosette, and Helminthosporium blight, other foot and root rots have been reported during the year. Important progress has been made in the investigation of the disease that occurs in Kansas where it was reported from the six following counties during 1922: Riley, Jefferson, Dickinson, Sedgwick, Rice, and McPherson. An extensive co-operative project between the Kansas Experiment Station and the Office of Cereal Investigations is established at Abilene, Kansas, where crop rotations, soil fertilizers, soil sterilization, and varieties are being studied. Vojnowicia graminis (McAlp.) Sacc. & D. Sacc. has been found associated with this Kansas disease and the same fungus has also been collected during the past year in New York, where Kirby reports it on Dawson and No. 6 Junior, and in Oregon where Barss reports its occurrence in Union County.

Sclerotium rhizoides Auersw. was reported from Fremont County, Idaho, killing plants during the winter and early spring. The damage ranged from 1 to 50% loss in infested fields. Regarding it, Hungerford reported as follows:

> "Some time ago, I received specimens from the same county where the Helminthosporium root rot of wheat occurred last year, of a Sclerotium disease of wheat. I sent some to Dr. Humphrey and to Mrs. Patterson. A few days ago, I received a letter from Miss Charles stating that the disease was probably Sclerotium rhizoides. It appears that this disease has never been seen but once before

WHEAT - Black chaff

Varieties reported as affected by black chaff are Kanred in Wisconsin, and Marquis, Preston, and Kota in North Dakota.

Table 70. Losses from and relative importance of black chaff of wheat, as reported by collaborators, 1922.

State	Importance 1922	Amount compared with 1921	Amount compared with Average year	Percentage loss
Oklahoma	Very important	More	More	2
Arkansas	None	Same	Same	0
Wisconsin	Minor	---	---	0
Iowa	Very little found	---	---	0
North Dakota	More found than in any previous year	More	More	Trace
South Dakota	Little	Same	Same	0
Kansas	---	Somewhat more	Trace	0

Anthracnose caused by Colletotrichum cereale Manns

Anthracnose was reported from New York, Pennsylvania, Delaware, Maryland, Virginia, Kentucky, Louisiana, Arkansas, Ohio, Indiana, Wisconsin, and Iowa. In Ohio it was much more prevalent than during 1921, and was the most destructive disease of wheat, according to R. C. Thomas, who said that while the disease occurred throughout the state it was more severe in the southern and western portions and in fields where wheat followed wheat. The total loss due to it was placed at fifteen or twenty percent. The injury described as due to anthracnose in Ohio is similar to the so-called "broken straw" reported from Kentucky and to similar diseases of unknown cause found in other states (see "broken straw" page). Other states reporting more of the disease than usual were New York, where the loss was estimated at 1%, and Pennsylvania. A loss of one-half percent was reported from Virginia, where the disease was said to be more common in the southeastern part. In other states where it occurred anthracnose was of little or no importance. The disease does not occur in Connecticut or Washington, according to collaborators.

Recent literature

Anthracnose disease ..... Ohio Agr. Exp. Sta. unnumb. leaflet. July 11, 1922.
Pl. Dis. Bul. 6: 27, 49. 1922.

Diseases caused by Septoria spp.

George F. Weber, in his recent paper on Septoria diseases of wheat (1) says:

"On wheat there are two diseases caused by different species of Septoria, namely, S. nodorum Berk. and S. tritici Desm. The one, caused by S. nodorum, attacks the glumes most commonly, pro-

ducing brown blotches on them, hence it has been called 'Glume Blotch.' ..... This disease may also attack the rachis, culms and leaves. The other disease, caused by S. tritici, attacks the leaves only, producing conspicuous light colored lesions in which the dark colored pycnidia are prominent and produce a speckled appearance. On account of this outstanding characteristic the name 'Speckled Leaf Blotch' is here suggested for this disease."

Glume blotch caused by Septoria nodorum Berk.

According to Weber, the glume blotch of wheat is widely distributed in the wheat-growing sections of the United States, but has been reported as most prevalent from the South and from the east-central states. Ordinarily the damage due to it is probably small, but it is sometimes reported as causing severe local losses.

When retained in pycnidia, pycnospores remain viable over winter in the vicinity of Madison, Wisconsin. The leaves may be infected at any time during spring, summer, or fall, while on the heads infection probably takes place about the time they appear out of the sheath.

In 1922 collaborators reported the glume blotch from Connecticut, New York, Pennsylvania, Delaware, Maryland, West Virginia, Virginia, Kentucky, Tennessee, Alabama, Arkansas, Wisconsin, Kansas; and in Canada it was reported from New Brunswick, (G. C. Cunningham) Saskatchewan, (W. P. Fraser) and Alberta, (G. E. Delong). The importance of the disease in the various states is indicated in the following table.

Table 71. Relative prevalence and importance of glume blotch of wheat, as reported by collaborators, 1922.

State	Prevalence and importance 1922	Amount compared with 1921	Amount compared with Average year	Amount of loss or damage
New York	General, moderate	Much more	--	.5-1%
Delaware	General, not important	Less	Same	---
Maryland	Most on Coastal Plain	More	More	.5%
Virginia	Especially in south	--	--	.5%, perhaps more
West Virginia	Slight importance	Same	Same	Apparently very slight
Kentucky	General	Much more	Much more	1% or less
Alabama	Slight, general	--	--	1-%
Arkansas	Slight	Same	Same	?
Wisconsin	--	Less	--	--
Alberta	--	--	--	Trace
New Brunswick	Very important, general; one of the chief causes of poor crops			
Saskatchewan	Not much observed, southern			

Regarding the loss of one-half percent reported from Virginia, Fromme says:

"The damage may be considerably in excess of the estimate, but there is little definite information in regard to injury from this disease."

WHEAT - Glume Blotch

Maryland and Kentucky both report a wet season as very favorable to the disease, while in Wisconsin the weather was too dry during the heading stage of wheat to permit the development of the usual amount.

According to the results of inoculation experiments conducted by Weber, Poa pratensis, rye, and all species of wheat may be attacked by this disease. In the case of rye, however, only the leaves are affected, while with both wheat and Poa pratensis all parts of the plant above ground are susceptible. Triticum spelta, T. monococcum, and T. dicoccum were less susceptible than the other species inoculated, - T. durum, T. aestivum, T. compactum, T. turgidum, and T. polonicum. No especial difference in the susceptibility of the several varieties of T. aestivum was noted. The relative susceptibility of a number of varieties of wheat to this disease as observed at the Kentucky Agricultural Experiment Station and reported by Valleau is indicated in table 72.

Table 72. Susceptibility of wheat varieties to Septoria glume blotch at the Kentucky Agricultural Experiment Station, July 1, 1922.

Severity of Infection	Variety	Severity of infection	Variety
0	Alabama, C. I. 5785	0	Malakoff, C. I. 4898
0	Beloglina P 758 C. I. 1544	0	Mammoth Red 52, C. I. 5587
+++	Big Harvest Fultz - Purdue	++	Mediterranean, C. I. 3332
+++	Diamond C. I. 5710	++	Mediterranean, C. I. 5614
0	Dietz Longberry, C. I. 5570	++	Mediterranean, C. I. 5834
0	Early Red Chief, C. I. 3582	++	Michigan Amber, Purdue
++	Eclipse, C. I. 5674	+	Michikoff, Purdue
0	Economy, C. I. 3397	+++	Missing Link, C. I. 4866
0	Egyptian, C. I. 3049	++++	Nixon, C. I. 4867, Row 864
++	Farmer's Trust, C. I. 3346	++	Pennsylvania 44
0	Fulcaster, C. I. 3407	++++	Poole, C. I. 3366
0	Fultz, C. I. 4809	++++	Red Cross Row 33
0	Fultz, Row 226	+	Red Hussar, C. I. 4843
0	Fultzo-Mediterranean, C. I. 5353	++	Red Rock, Row 1115
0	Gluten B 86, C. I. 3427	0	Red Wonder, C. I. 5817
0	Golden Wave, Row 85	+	Sibley New Golden, C. I. 3520
0	Harvest Queen, C. I. 5314	0	Squarehead Master, C. I. 3283
0	Hickman, C. I. 5313	0	Stoner (Miracle), C. I. 5665
0	Hybrid 10c 5-2-4 Purdue	0	Stoner, C. I. 5777
++	Ill. Chief, Purdue	+	Trumbull, C. I. 5657
+	Imperial Amber, C. I. 4860	+	Turkey Minn. 1549
+++	Jolly Farmer, C. I. 5858	0	Turkish Amber, C. I. 5829
+	Kanred P-762, Kan. 2401	0	Valley, C. I. 3376
0	Lancaster-Fulcaster, C. I. 3455	0	P-1066 Kan. 2415
0	Lebanon, C. I. 3456	0	

++++ Indicates severe infection. 0 Indicates very little or no infection.

New York: Velvet-chaffed varieties seem to have heavier infection than the smooth-chaffed. (Chupp)

Maryland: Fultz is very susceptible (Temple and Jehle)

New Brunswick: Dawson's Golden Chaff, a fall variety, at least shows resistance, if not immunity. (G. C. Cunningham in Third Ann. Rept. of Canadian Plant Disease Survey).

peckled leaf blotch caused by Septoria tritici Desm.

As is the case with the glume blotch, the speckled leaf blotch is also idely distributed in the United States, according to Weber. It has been reported rom almost every wheat-growing state. The loss due to this disease is very diffiult to determine. It seems to be greatest on seedlings in the fall and on tillers n the early spring. Under favorable conditions the disease may cause serious damge, and even death of plants. The pycnospores remain viable throughout the winter hen retained in pycnidia, and the fungus overwinters in this stage. Wheat plants ave become infected during every month except January and February in the vicinity f Madison, but the amount of new infections was less in late fall and early spring han during late spring, summer, and early fall. Volunteer seedlings are very imortant in the spread of the disease, since they serve to carry it over from harest until the time when winter wheat has germinated. Early fall plantings are njured less than late sowings and the fungus attacks rapidly growing plants less asily than those growing more slowly. Septoria tritici attacks Triticum spp., ye, and Poa pratensis.

In 1922 collaborators reported the disease from New York, Delaware, Maryland, est Virginia, Kentucky, Arkansas, Indiana, Wisconsin, Kansas, Idaho, and Caliornia. Kansas reported that it was much more prevalent than usual. In Kansas, ccording to Melchers, it was "by far the most common ever noticed." The greatest oss (1/2 to 1%) was reported from New York. In other states it did not exceed a race, and Kentucky and Arkansas reported that the disease caused no loss. In rkansas the disease is said to appear only early in the spring, and afterwards to isappear. In Indiana, according to Kendrick, it is serious early in the spring.

iterature (Cited):

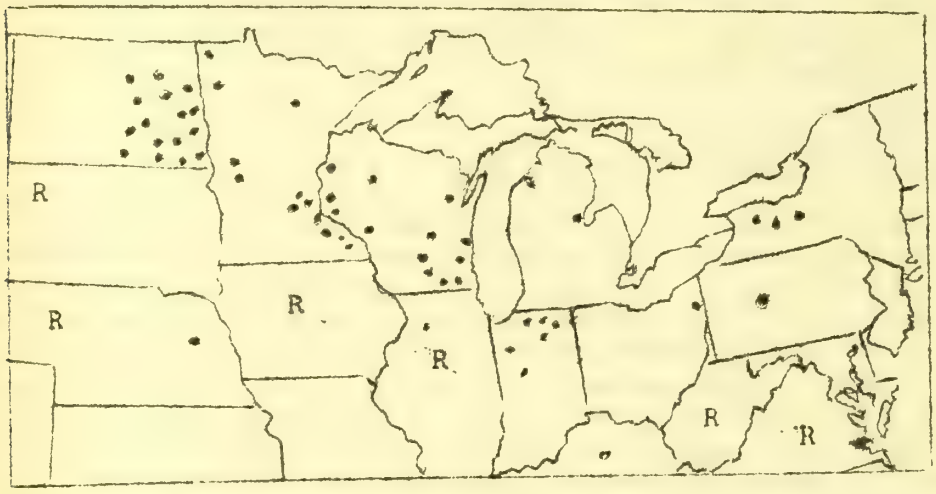
(1) Weber, George F. Septoria diseases of cereals II. Septoria diseases of wheat. Phytopath. 12: 537-585. Dec. 1922.

Ergot caused by Claviceps purpurea (Fr.) Tul.

The accompanying map (Fig. 28) gives the distribution of ergot on wheat as t has been reported to the Survey up to the present time. It will be noted that he map records occurrence only, severity and importance not being indicated. The isease has been reported most frequently from North Dakota and Minnesota.

In 1922 ergot on wheat was reported from New York, West Virginia, Wisconsin, linnesota, Iowa, and North Dakota. The disease was of little importance apparenty, only traces of it occurring even in North Dakota, where it was so conspicuous n 1921. Miss Weniger reports two factors to which this reduction in prevalence ay be due: first, there was probably too little moisture for the germination of he sclerotia (sclerotia overwintered at Fargo failed to germinate); and second,

many farmers in the northeastern counties, where the disease was most abundant in 1921, floated the ergot bodies out of their seed wheat.



R= reported but locality not given

Reports received from Arizona (Maricopa and Coconino Counties) and Utah also.

Fig. 28. Distribution of ergot on wheat as it has been reported to the Plant Disease Survey, 1908-1922. Each dot indicates a county from which the disease has been reported.

In Canada, according to the Dominion Plant Disease Survey, ergot was found occasionally in southern Saskatchewan on durum wheat, in Manitoba, and New Brunswick, but was in no case important.

According to the following statements made by R. O. Cromwell, ergot in wheat is of more importance than would be indicated by its effect on the yield.

> "I was told by a local miller, who is somewhat of a practical man, that out of 100 cars offered to them at one time, only one was acceptable; the rest were rejected largely because of the presence of ergot, which they could not separate from the grain. This, of course, is nothing like representative of the crop as a whole. Any durum wheat rejected because of ergot would be sent for export. I understand that in the last two or three years ergot has affected somewhat the demand from importers for our durum wheat." (Dec. 1, 1922)
>
> "These cars came on the market early in the movement of the spring wheat crop and for the last month or so there has been much less trouble from this source. There is much less ergot than in 1921, but the territory involved is perhaps not a great deal smaller. Infection has occurred farther west than ever recorded by the trade.
>
> "Only small traces usually make this grain undesirable to local millers who are to make semolina. This product is rather coarse and the small pieces of ergot show up very plainly and it is impossible to remove them from the wheat because of equal size and specific gravity with the kernels.
>
> "From the standpoint of actual loss to wheat, ergot was unimportant in 1922, but as a pathological problem it is probably almost as important." (Jan. 22, 1923)

Powdery mildew caused by Erysiphe graminis DC.

Powdery mildew on wheat was reported from New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Kentucky, Arkansas, Ohio, Indiana, Wisconsin, Minnesota, Iowa, Kansas, Idaho, Oregon, and California. In New York it caused a loss of 1%, according to Kirby. In Pennsylvania the amount of damage due to it was not known. In other states from which it was reported the disease was unimportant and the loss caused was negligible or none. In Maryland, Virginia, and Kansas the loss was estimated at a trace.

Vaughan reports that in Wisconsin the disease caused a blight on winter wheat in the fall. Little Club wheat is said by Hungerford to be very susceptible to powdery mildew in Idaho.

Black point caused by a number of fungi

In a recent paper by Henry (2), it is reported that black point of wheat was produced artificially by inoculation with Helminthosporium sativum, Helminthosporium sp., Brachysporium and Stemphylium, all of which were isolated from black pointed kernels. Weniger (3) and Evans (1) report Helminthosporium sativum as being associated with most of the black pointed kernels. The disease occurs particularly in the spring wheat area and is apparently most common on the durum varieties.

Literature (Cited):

(1) Evans, Nevada S. "Black point" of wheat. Phytopath. 11: 515. Dec. 1921.

(2) Henry, A. W. Some fungi causing black point of wheat. (Abstract) Phytopath. 13: 49. Jan. 1923.

(3) Weniger, Wanda. Pathological morphology of durum wheat grains affected with "black point." (Abstract) Phytopath. 13: 48-49. Jan. 1923.

Seedling blight caused by Fusarium sp.

Slight amounts of this disease were reported from New York, North Dakota and from Manitoba (See also scab, page)

Broken straw

Statements from collaborators concerning a breaking over of wheat straw have been reported from Kentucky (Pl. Dis. Bul. 6: 27, July 15, 1922) and Montana (Pl. Dis. Bul. 6: 51, Aug. 1, 1922). In the former state as much as 6% damage is estimated on account of the sudden ripening and twisting and breaking of the stems at the top or second joint. Different varieties in the same field showed marked differences in susceptibility to this breaking over, according to Valleau. From the upper nodes of affected plants Fusarium, Helminthosporium, Alternaria and other fungi were isolated. It has been suggested that infection by leaf rust might have been responsible for at least a part of this injury.

In Montana the stems were reported as breaking over at points six or eight

inches below the heads. Dark colored lesions were found on the leaf sheaths and culms the characteristics of which suggest a bacterial cause, according to H. M. Jennison.

From Canada a somewhat similar disease called "crinkled joint" was reported in 1922, which was characterized by a kink or abrupt bend on the lower internodes of the stem. As the plant became old the stems broke at this point and the plant fell over. This was reported both from Alberta and Saskatchewan. (Canadian Plant Disease Survey report 1922)

Mosaic (Undet.)

From Nebraska, G. L. Peltier reports a mosaic of wheat. Plants showing the disease were found in a large number of both winter and spring wheat varieties at Lincoln, Nebraska. Preliminary inoculations in the greenhouse using the juice of infected plants gave positive results in some instances on wheat and corn. Aphids found feeding on mosaic wheat plants in the field were transferred to young corn plants in the greenhouse and a slight infection was produced on one plant. Seed from infected plants produced individuals showing no more mosaic than plants from healthy seed sown as a check. (See also rosette of wheat, page 205).

Other diseases

Basal glume rot caused by Bacterium atrofaciens McCulloch was first described in 1920 (McCulloch, Lucia. Basal glumerot of wheat. Jour. Agr. Res. 18: 543-552. Feb. 16, 1920). It was found by Miss McCulloch in collections from New York, Michigan, Kansas, Missouri, Minnesota, North Dakota, Oklahoma, and Alberta. It has never been reported to the Survey by collaborators. In 1922 the disease occurred in Saskatchewan, Manitoba, and Alberta, according to the Canadian Plant Disease Survey, but was not common or severe in any case.

Sooty mold caused by Hormodendrum cladosporioides Sacc. - California: "Considerable damage to wheat near the coast but less than last year." (Mackie).

Stripe, cause unknown - trace in Genesee County, New York (Kirby). Stripe has been reported from New York every year except 1920 since 1917, and according to J. G. Dickson, the disease has been common in Illinois and Wisconsin at least.

Vegetable proliferation of heads - Indiana and Oregon (Pl. Dis. Bul. 6: 87, Sept. 1; 100, Sept. 15, 1922).

RYE

Stem rust caused by Puccinia graminis Pers.

Rye was damaged only very slightly by stem rust in 1922. The disease was reported in the majority of the states east of the Mississippi River and from Minnesota, Iowa, the Dakotas, Nebraska, Kansas, Arkansas, Colorado and Utah, but none of these states rate the disease as important on rye. In fact, the only states estimating any particular damage from this disease are Ohio with 1%, and Illinois and Minnesota both with .5%.

Collaborators in North Dakota make the statement that Puccinia graminis has not been severe on rye for the last four or five years. No reports of damage

RYE- Stem rust, leaf rust.

) rye are given in the Canadian survey report for 1922.

ecent literature:

Levine, M. N. and E. C. Stakman. Biologic specialization of Puccinia graminis secalis. (Abstract) Phytopath. 13: 35, Jan. 1923.

Leaf rust caused by Puccinia dispersa Eriks.

Summary by E. B. Mains

"The leaf rust of rye was about as widespread as the leaf rust of wheat, but apparently not as severe. It was found present fairly heavily in Georgia, South Carolina, Virginia, Tennessee, Kentucky, Indiana, Illinois, and Wisconsin, being especially noticeable in Georgia, South Carolina, Tennessee, and Kentucky. The loss is much more difficult to estimate than the leaf rust of wheat, but probably averages about 1-2%. That the aecial stage of this rust may occur naturally in this country is shown by our discovery (1) of it on Anchusa used as a border plant for flower gardens at Lafayette. In view of the widespread occurrence of the rust in this country without this stage, it is doubtful if it will prove to be of much importance.

"Considerable progress has been made in obtaining strains of rye resistant to leaf rust. Plants highly resistant to leaf rust have been found in all the varieties tested,-Star, Rosen, Mammoth Winter, Abruzzes, Petkus, Giant Winter, Virginia, Henry, Ivanov, St. John, Von Ruemker, Invincible and Mexican. The best of these have been grown to maturity and further selections and studies are being made."

Table 73. Estimated percentage loss from leaf rust of rye, according to collaborators, Plant Disease Survey, 1922.

Estimated percentage loss	States	Estimated percentage loss	States
2	Ohio, Indiana, Illinois	.5	Delaware, Alabama
1.5	Connecticut, New York, Virginia, South Carolina, Georgia	Trace	Pennsylvania, West Virginia, Mississippi, Wisconsin, Minnesota, Iowa, North Dakota, Kansas, Oklahoma, Colorado, California.

Literature cited:

(1) Mains, E. B. and H. S. Jackson. Aecial stages of the leaf rust of barley, Puccinia simplex, and of rye, P. dispersa, in the United States. (Abstract) Phytopath. 13: 49. Jan. 1923.

RYE - Scab, Anthracnose, Powdery mildew, Stem smut

Scab caused by Gibberella saubinetii (Mont.) Sacc.

Very slight amounts of scab were reported on rye this year fron New York, Delaware, Ohio and Wisconsin. Numerous collaborators in other states reported not having observed the disease on this host. The disease was of practically no economic importance.

Anthracnose caused by Colletotrichum cereale Manns

Anthracnose was reported from most of the states in the northeastern quarter of the country and from Oklahoma. Judging from the reports received, the disease was probably more serious than is usual. Ohio was apparently the center of the epidemic and in that state it is estimated that about one quarter of the crop was lost on account of this disease. It appeared in late June and by attacking the base of the culms, caused shriveled grain and fallen straw. It was generally distributed over the state but was worst in the western and southern portions. It was by far the worst disease of the crop in that state. Rosen rye suffered a heavy loss.

Other losses reported are as follows: New York, 1%; Virginia, 2%; Indiana, 4%; and Oklahoma, .5%. In Oklahoma the disease was reported as being important in the northern part of the state.

Powdery mildew caused by Erysiphe graminis DC.

Although powdery mildew was reported on rye only from Delaware, Maryland, West Virginia, Ohio, Indiana, Wisconsin, Minnesota, Iowa, and California, it was probably somewhat more prevalent on rye this year than usual. In Minnesota heavy infection was observed locally in the east central part of the state, it being first observed May 29.

Stem smut caused by Urocystis occulta (Wallr.) Rab.

A few occurrences of stem smut were reported during 1922, from Maryland, Virginia, West Virginia, Indiana, Illinois, Wisconsin, Iowa, and North Dakota. Apparently it was more common in Minnesota, as high as 1% loss being estimated for that state with some fields showing as much as 10% infection. From North Dakota collaborators report that the disease has never been severe in that state as far as records show and in 1921 it was reported from only one locality, on June 20.

Recent literature:

Müller, H. C. and E. Molz. Neue versuche zur bekämpfung des roggenstengelbrandes, Deut. Landw. Presse 49: 491. 1922.

Head smut caused by Ustilago sp.

Reports of collections of the head smut of rye were received from three states by the Plant Disease Survey during 1922. One infected head of volunteer rye was collected on May 20 at Ithaca, New York; and at the United States Depart-

ent of Agriculture Experiment Farm at Arlington, Virginia, H. B. Humphrey and . F. Tapke, found a considerable number of specimens occurring naturally in some f the varietal test plots. In Madison County, Illinois, the men engaged in the heat flag smut survey found a number of plants affected with loose smut in a number of different places during May and June.

An examination of past survey records shows that this disease has been collected in other years from the following states: New York, Virginia, Tennessee, Indiana, Illinois, Missouri, Oklahoma, Minnesota, and North Dakota.

Ergot caused by Claviceps purpurea (Fr.) Tul.

Ergot of rye was reported rather frequently from states where the crop is grown. As usual, volunteer rye was reported as especially affected. In none of these states were especially heavy losses sustained. Estimates of one half of one percent loss have been received from Ohio, Illinois, and North Dakota, and one percent loss was estimated as occurring in Minnesota. In that state slightly more of the disease was reported than usual, occurring in all fields to a greater or lesser extent. The earliest reported appearance in Minnesota was June 11, in Dakota County. In North Dakota less ergot occurred than during 1920 or 1921. Concerning this W. Weniger reports as follows:

> "With rye harvest over, and many fields already threshed, there has been little report of the occurrence of ergot. Last year there was heavy infection, but this year it is very slight. Locally, there was some ergot, and also evidence of blighting of kernels due to infection by Claviceps. The weather has apparently been unfavorable for germination of sclerotia at Fargo, since various lots of them, overwintered out of doors and also in doors, failed to germinate in the field.
>
> "Some spring rye was found heavily infected at Dickinson July 25th, but the winter rye beside it was almost free from infection. Volunteer rye was generally infected."

In a recent paper by W. W. Bonns (1) the commercial value of ergot in the manufacture of pharmaceutical preparations is brought out. It is stated that the annual import of ergot into the United States for the six years ending with 1919 ranged from 58 to 112 tons with a valuation ranging as high as $208,000. The statement is further made that, -

> "The great commercial sources of the sclerotia in the past have been Spain and Russia. During the recent war, American drug manufacturers experienced a great shortage of ergot, and as a result quotations rose by leaps and bounds. In the early part of 1914, high-grade Russian ergot could be bought for 43 cents a pound, duty paid. During the first part of 1920, quotations on this drug ranged between $5.00 and $6.00 a pound."

Recent literature:

(1) Bonns, W. W. A preliminary study of Claviceps purpurea in culture. Amer. Jour. Bot. 9: 339-353. July 1922.

Pammel, L. H. Ergotism. Vet. Med. 17: 89. 1922.

RYE - Miscellaneous diseases

Other diseases

Bunt caused by Tilletia tritici (Bjerk.) Wint. has been artificially produced in rye at the Washington Agricultural Experiment Station by Dr. E. F. Gaines.

Take-all caused by Ophiobolus cariceti (Berk. & Br.) Sacc. occurred in New York on rye growing in ground heavily infested with the organism, according to Kirby. The disease caused a slight stunting of the plants. It is not of economic importance on rye in New York. First observed June 28 at Auburn.

Leaf spot caused by Helminthosporium sativum P. K. & B. The Section of Plant Pathology of the University of Minnesota reports less of this disease than usual, only three observations having been made during the year. The disease, however, was probably general over the state.

Septoria secalis, Prill. & Delacr. - reported by J. G. Dickson as abundant early in the season, but the cause of little damage in Wisconsin. Weber (1) has reported this as occurring in the past in West Virginia, Virginia, Illinois, and Wisconsin.

Leaf blotch caused by Rhynchosporium secalis (Heins.) Davis - scattered infections early in season reported by J. G. Jackson in Wisconsin.

Bacterial blight caused by Bacterium translucens fairly abundant in Wisconsin early in the season, according to J. G. Dickson.

Bacterial leaf spot was noted on rye in plots at Moscow, Idaho, according to C. W. Hungerford.

Failure of rye. In Kentucky each year numerous fields of rye come to the heading stage and fail to fill seed. Often crop is entire loss. Seems to be root trouble, but not certain. All small grain affected in same way to some extent but not so marked as with rye. (Valleau)

Literature cited:

(1) Weber, George F. Septoria diseases of cereals III. Septoria leaf blotch of rye. Phytopath. 13: 1-2. Jan. 1923.

BARLEY

Covered smut caused by Ustilago hordei (Pers.) K. & S.

Covered smut occurred during 1922 in about normal amounts, judging from collaborators' reports. A considerable number of states rated the disease as relatively unimportant, but in some of them, especially Kentucky, Texas, Oklahoma and Kansas the disease was a considerable factor in reducing yield.

The following losses were reported:

3% . . . Connecticut, Georgia, Texas, Oklahoma, Kansas
2 . . . Vermont, Iowa
1 . . . Minnesota, North Dakota, California
.5 . . Alabama, Wisconsin, Idaho

A number of other states reported less than 1% loss.

In California, W. W. Mackie reported the disease as very scarce over the entire state, but occurring most plentifully where optimum moisture conditions prevailed. Wet weather and wet soils are apparently favorable for covered smut, according to Mackie.

BARLEY - Covered smut, Loose smut

Seed treatment experiments with the use of organic mercury compounds have been conducted during the past few years by W. H. Tisdale and J. W. Taylor (1) of the Office of Cereal Investigations. A considerable number of the materials tried caused improved germination of oats and barley in the greenhouse and in the field, increased field stands and controlled barley smuts excellently. Seed treatment tests by Mackie in California indicate that:

> "The bluestone lime method is best for dry sown barley in the interior. Formaldehyde may be used with late sown barley or in the Coastal regions. Copper carbonate dust is not as fully effective as the fungicide just mentioned."

More covered smut was observed in hooded barley in Wisconsin than in other types of this cereal, according to R. E. Vaughan. However, hooded barley is not extensively grown in the state.

Literature cited:
(1) Tisdale, W. H. and J. W. Taylor. Organic mercury seed disinfectants. Phytopath. 13: 38. Jan. 1923.

Loose smut caused by Ustilago nuda (Jens.) K. & S.

The only states recording loose smut as of much importance during 1922 are New York, Virginia, Kentucky, Indiana, Texas, Oklahoma, Iowa, and Kansas. Judging from reports it was prevalent in about the same amounts as usual. On account of the similarity of this smut to the covered smut, it is possible that the two are sometimes confused in plant disease survey reports.

Losses reported during 1922 are as follows:

5%	Virginia
4	Oklahoma
3	Kentucky, Texas, Kansas
2	New York, Indiana, Iowa
1	Maryland, North Dakota
.5	Illinois, Wisconsin, Minnesota
Trace	Vermont, Massachusetts, Tennessee, Colorado, Utah

Successful results were obtained with the hot water treatment on a number of farms in Kentucky during the year. The practice of treating barley seed with hot water is increasing in that state, according to Valleau.

Recent literature:
Foëx, E. Un charbon de l'orge. Journ. Agr. Prat. 149 (n. s. 38): 181. Aug. 26, 1922.

Stem rust caused by Puccinia graminis Pers.

In 1922 the stem rust of barley was reported of importance only in the north-central states. It occurred in widely scattered localities from Vermont to California and from Alabama to Canada, but apparently it was of economic importance only in the states shown on the accompanying map (fig. 29). In a con-

siderable number of these states it was noted that the disease was especially severe on barley near barberries. From the data at hand it would appear that wheat suffered the greatest loss from stem rust, with barley, oats, and rye following in the order named.

From the middle western provinces of Canada reports indicate that the rust was common on barley but did not cause much damage. On the other hand, on Prince Edward Island the disease was not only common, but was the cause of severe loss in several cases. (Canadian Plant Disease Survey report 1922).

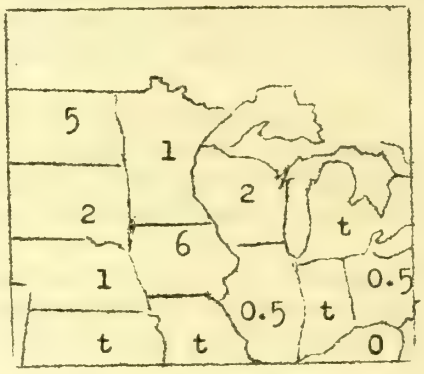


Fig. 29. Estimated percentage of los from stem rust of barley, 1922.

Leaf rust caused by Puccinia simplex (Koern.) Erikss. & Henn.

Leaf rust of barley was reported to the Survey in 1922 from Connecticut, New York, Delaware, Maryland, Virginia, Kentucky, Georgia, Alabama, Louisiana, Indiana, Wisconsin, Iowa, and California. According to G. R. Bisby, the rust was collected for the first time in Manitoba.

Summary by E. B. Mains:

"The leaf rust of barley is apparently only severe locally. It was found attacking barley fairly heavily at Experiment, Georgia; Blacksburg, Virginia; Lexington, Kentucky; and to somewhat less extent at Washington, D. C. It probably caused a moderate reduction in yield at these places, but the average for the country is undoubtedly very slight.

"We have this spring successfully repeated Tranzschel's work carried out in Russia in 1914, infecting Star-of-Bethlehem, Ornithogalum umbellatum, with the rust, producing the aecial stage (1) both in the greenhouse and in the field. This connection may be of importance in regions like southern Indiana, where Star-of-Bethlehem has escaped and become a serious weed, if winter barley should become widely grown. At least it should be called to the attention of pathologists as a dangerous neighbor in barley culture."

Literature cited:

(1) Mains, E. B. and H. S. Jackson. Aecial stages of the leaf rust of barley, Puccinia simplex, and of rye, P. dispersa, in the United States. (Abstract) Phytopath. 13: 49. Jan. 1923.

Stripe rust caused by Puccinia glumarum (Schm.) Erikss. & Henn.

(See wheat page 220).

Net blotch caused by Helminthosporium teres Sacc.

In 1922 net blotch was reported from New York, South Carolina, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, Colorado, and California. According to the report of the Canadian Plant Disease Survey it also occurred in Alberta, Saskatchewan, and Manitoba. The more important of the state reports are as follows:

Wisconsin: Less than last year, developed abundantly late in season on volunteer plants. (Vaughan)

Minnesota: Found on University Farm early in June, and in McLeod County during the latter part of July. Difficult to say how much damage was caused by net blotch. (Sect. Plant Path.)

South Dakota: Same as last year, abundant in some fields, 1% reduction in yield for state. (Evans)

California: Noticeably less over the state this year, and as usual appearing in greater quantity on early and volunteer barley. (Mackie)

Dates of first appearance:

April 25, Clemson College S. C.
June 1, Ramsey County, Minn.
June 3, Racine Wis.
July, Ithaca, N. Y.
July, Brookings, S. D.
July, Fort Collins, Col.

Stripe caused by Helminthosporium gramineum Rab.

During 1922 state collaborators reported the following losses from stripe:

Trace, Vermont, New York, Delaware, Maryland, Virginia, Oklahoma, Colorado and Idaho.
0.5%, Wisconsin
.1%, North Dakota
2%, Indiana and Minnesota
3%, Tennessee
4%, Utah
5%, Iowa

In the majority of the states the disease was prevalent in about the same amounts as usual and was relatively unimportant. However, Iowa and Utah reported 5 and 4% loss, respectively, and from Ohio and Wisconsin more of the disease than usual was reported. From the latter state, R. E. Vaughan reports: "More than last year but not serious as in 1917 and 1918. 19% on Wisconsin Pedigreed #6 barley was found in several fields." The Canadian Plant Disease Survey reports the disease as common in Alberta, Manitoba, Saskatchewan and Prince Edward Island.

Dates of first appearance.

June 1, Ramsey County, Minn.
June 3, Racine, Wis.
June 28, Auburn, N. Y.
July 6, Ashland County, Ohio
July, Fort Collins, Col.

Reference cited:

Riehm, Eduard. Die streifenkrankheit der gerste. Flugbl. Biol. Reichanst. Land- u. Fortstw. 68. Sept. 1922.

BARLEY - Spot blotch, Scald, Root rots

Spot blotch caused by Helminthosporium sativum P. K. & B.

During 1922 spot blotch was reported from New York, Wisconsin, Minnesota, Iowa, Colorado, and California. In most cases it was of relatively slight importance but in New York it was estimated that it occurred in practically all of the fields in the state and probably reduced the yield about 3%. In Minnesota also the organism caused a spotting of the leaves and a foot and root rot occurring in all fields and probably reducing the state yield 2%. In that state injury through rotting of the roots and base of the plants appears to be considerably greater than that caused by the blotches on the leaves. From California no estimates of damage were received, but W. W. Mackie makes the statement that it was prevalent and about as usual, appearing at its maximum late in the season. R. E. Vaughan in Wisconsin reports more spot blotch on the very early plantings than on the later ones.

Scald caused by Rhynchosporium secalis (Heins.) Davis

Wisconsin, Iowa, Idaho, Oregon, and California report scald in 1922. In Wisconsin it was general early in the season but not severe and minor in importan for the state as a whole. In Idaho, Hungerford reported less of the disease than the average, but common throughout the state, although unimportant. In Oregon it was common but not reported as causing much loss. From California W. W. Mackie reports the following:

> "Scald attack was less severe this year but occurred in all fields over the State. As usual early sown barley suffered most. A number of barley hybrids bred for scald resistance have proved highly resistant to scald, combined with high yield, good quality of grain and resistance to lodging."

The disease was also reported by the Canadian Plant Disease Survey from Edmonton, Alberta, Canada, in 1921 and 1922. According to them these are the firs reports of this disease in Canada (Canadian Dept. Agr., Div. Bot. Surv. Pres. Pl. Dis. Dom. Canada, 1922, 3rd Ann. Rept.).

Root rots probably caused by Fusarium sp.

The two following reports on barley root rots have been received:

Illinois: We have one report only of root rot of barley this season. It comes from Will County and is reported to be present in serious form in two fields only. The roots and culms have a pinkish color leading one to suspect Fusarium. (L. R. Tehon)

California: Common in nearly all fields but less injurious than last year Attacks on wheat, barley and oats. (Mackie)

Miscellaneous diseases

Scab caused by Gibberella saubinetii (Mont.) Sacc. Scab attacking heads of barley was found in New York, Maryland, Ohio and Wisconsin. In no instance was i causing particular damage.

BARLEY - Miscellaneous diseases

Powdery mildew caused by Erysiphe graminis DC. New York, Delaware, and Kentucky report powdery mildew in barley. No particular damage was recorded. In Kentucky a case is reported where barley plants were heavily infected while in adjoining wheat the powdery mildew was practically absent.

Anthracnose caused by Colletotrichum cereale Manns reported from Wisconsin, Texas, and Louisiana.

Leaf blotch caused by Septoria passerinii Sacc. is reported by Weber (1) as having been found in other years in Wisconsin, Minnesota, and the Dakotas.

Ergot caused by Claviceps purpurea (Fr.) Tul. Minnesota and Idaho are the only states reporting infection of barley with ergot. In Minnesota light infections were found at the University Farm on ten different varieties, and in Idaho heavy infection occurred locally in Fremont County.

From Manitoba, G. R. Bisby reports that this disease was found at Winnipeg and reported as quite common at Morden.

A rusty spot of barley, cause undetermined, was reported by W. W. Mackie from California as follows:

> "Rusty spot of barley has been observed for four years. During 1922 it increased noticeably especially in the Sacramento Valley where fields near Woodland were practically ruined. The grain was reduced from malting to feed grade and the crop reduced to one-fourth."

Black spotting of leaves, cause unknown but distinct from spot blotch or net blotch, was fairly common in Idaho this year, according to C. W. Hungerford.

References:

(Cited):

(1) Weber, George F. Septoria leaf-blotch of barley. In Septoria diseases of cereals III. Phytopath. 13: 3-7. Jan. 1923.

(Not cited): Muller, H. Das gelbwerden der wintergerste. Deutsche Landw. Presse 49: 115-116. Feb. 25, 1922.

Zimmerman, Hans. Typhulapilzbefall der Wintergerste 1921. Nachrichtenbl. Deut. Pflanzenschutzd. 2: 41-42. June 1922.

OATS

Smuts caused by Ustilago avenae (Pers.) Jens. and U. Levis (K. & S.) Mag.

The two smuts continued to be the most destructive diseases of oats as usual. While some states reported less smut this year, others reported about the same as or slightly more than during 1921, so that for the United States as a whole there was probably less damage from oat smut than during 1921. The principal reasons for this may be found in a more general practice of seed treatment and in the weather conditions which, according to collaborators, were influential in cutting down the amount of smut in some cases.

The accompanying map gives collaborators' estimates of the percentage reduction in yield from the two smuts.

The maximum amount of smut found in any one field is of interest. Thus in Michigan from 25 to 35% by actual count was found in some untreated fields. In Wisconsin 30% was determined; in Virginia 25%; New York 25%; and in West Virginia 10%.

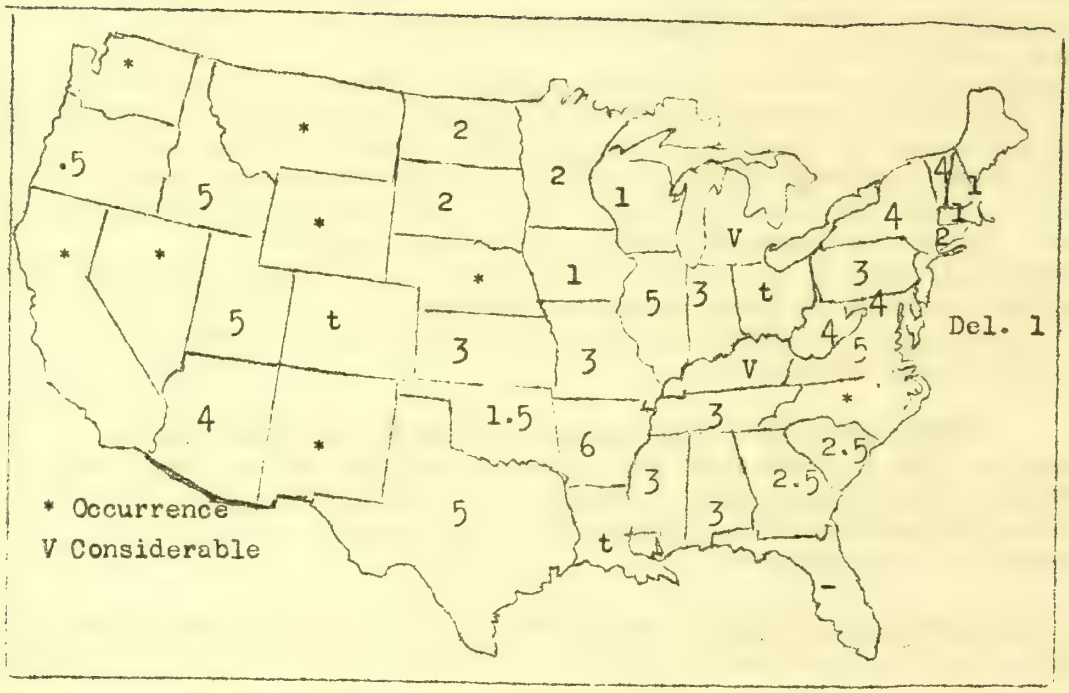


Fig. 30. Estimated percentage reduction in yield from oat smuts in 1922, according to collaborators. (For revised and final figures see crop losses from plant diseases in the United States in 1922. Pl. Dis. Bul. 30, 1923).

In parts of Ohio, Indiana, Illinois, Missouri, Nebraska, and Kansas the oats crop suffered considerably on account of weather conditions. Wet weather in the spring delayed planting in many cases, and dry weather prior to maturity caused further shrinkage. Collaborators in some of these states attribute variations in amount of smut to these conditions. The following reports are of special interest in this connection:

Ohio: Of less than average importance. A few fields were seen in northern Ohio in which the infestation was estimated at 5 to 8%. In most fields, however, the amount of smut was negligible. Increased interest in seed treatment is regarded as one factor in this condition. Owing to adverse weather conditions in early spring, difficulty was experienced in fitting the soil for oats and a large part of the planting was unusually late. It is suggested that the late planting was followed by favorable conditions for growth with the result that the period was shortened during which the seedlings were in the favorable stage for smut infection. (W. J. Young, Aug. 15).

Illinois: Present throughout the state, probably causing considerable loss. Early spring rains prevented planting until late, resulting in a poor crop in many places. Hence, the total loss from smuts this season should be less than usual. (L. R. Tehon, Aug. 15).

Wisconsin: More than usual, 1921 crop nearly a failure and purchased seed for sowing in 1922 brought considerable smut. (Vaughan, Aug. 15)

Success with organic mercury compounds as seed disinfectants for the control of oat smut has been obtained by the Office of Cereal investigations (1) These materials have not only controlled smuts on oats, but have increased the yields over those from untreated seed. The mercury compounds proved superior to copper carbonate or other dust treatments in the control of oat smut. Tests with these compounds are also being made in Kansas, according to L. E. Melchers.

Variation in susceptibility of varieties to oat smut were reported as follows:

Wisconsin: Pedigree No. 5 shows high degree of smut freedom when compared with other varieties and selections at the Spooner Branch Station. (Vaughan)

Minnesota: Sixty Day, White Tartar, Iowa 670, Iowa 103, Lincoln 505, the most susceptible varieties. (Section of Plant Pathology)

North Dakota: New Victory oats very severely attacked at Dickinson. (Weniger)

Kansas: Selections of Burt are showing marked resistance. (Melchers)

References (Cited):

(1) Tisdale, W. H. and J. W. Taylor. Organic mercury seed disinfectants. (Abstract) Phytopath. 13: 38. Jan. 1923.

(2) Zade, A. Experimentelle untersuchungen über die infektion des hafers durch dem haferflugbrand (Ustilago avenae Jens.) Fühl. Landw. Zeit. 71: 393-406. Nov. 1922.

Stem rust caused by Puccinia graminis Pers.

During 1922 slight amounts of stem rust of oats were reported from the eastern and southern states, but in none of these sections was the disease said to be the cause of more than a trace of damage. However, in the Dakotas, Minnesota, Wisconsin, Mighican and portions of Iowa, reports indicate that the disease caused damage, particularly to late planted oats. In Iowa and South Dakota, Melhus and Evans, respectively, report that the slight amount of damage this year was due to a late appearance of the rust.

The largest loss is reported from North Dakota. In this state as high as 5% reduction in yield is estimated by collaborators. In Minnesota infection was fairly general over the southern part of the state, but not heavy except in the vicinity of barberries. A loss of 2% is reported from Minnesota. In Wisconsin, late seeded oats were damaged but the majority of the oats were harvested before the rust became serious. R. E. Vaughan estimates an average loss of 1% for the state. According to R. T. Stanton (Cereal Courier 14: 230. Aug. 10, 1922) an epidemic of stem rust occurred on oats in southeastern Minnesota and northeastern Iowa. In local areas of northern Arizona and southern California, the disease was reported as doing damage.

Canadian plant disease survey reports show that stem rust on oats was severe in both western and eastern Canada last year. It was very severe on late

Oats in southern Saskatchewan, and probably lessened the yield to a considerable extent. The plant pathologists at Manitoba report it also severe on late oats in the southern part of that Province, while other records from Ontario, New Brunswick and Prince Edward Island report the disease as being of a serious nature, particularly late in the season.

Collaborators in Minnesota and North Dakota report White Russian oats as resistant. The variety Victory was reported as susceptible in Minnesota. Work on breeding oats resistant to stem rust is in progress at the Minnesota Agricultural Experiment Station (1).

Literature

(Cited):

(1) Griffee, Fred. Breeding oats resistant to the stem rust. Jour. Hered. 13: 187-190. 1922.

(Not cited):

Parker, J. H. A review of literature on the rusts of oats, with notes on their distribution in the United States. Proc. Kansas Acad. Sci. (51st-53d Ann. Meet.): 71-118. 1922.

Stakman, E. C., M. N. Levine and D. L. Bailey. Biologic specialization of Puccinia graminis avenae. (Abstract) Phytopath. 13: 35. Jan. 1923.

Crown rust caused by Puccinia coronata Cda

Fig. 31. Estimated percentages of loss due to crown rust of oats in the United States in 1922, according to collaborators.

Throughout the country as a whole more crown rust was reported during 1922 than in the preceding year, although in Louisiana, Arkansas, and Texas the losses

ere not so great. The following states report more of the disease than during 921: Connecticut, New York, Delaware, Georgia, Mississippi, Indiana, Illinois, nd North Dakota. Only Louisiana, Texas, Ohio, Iowa, and Kansas report less than n 1921. As usual the greatest damage occurred in the South where winter oats re grown especially. A glance at the accompanying map (Fig. 31) will show the igh percentage of loss in this section and also that considerable losses were ustained in a number of other states as well. Crown rust is second to the oat muts in importance.

Table 74. Dates of earliest appearance of crown rust.

On Rhamnus		On oats	
Date	Place	Date	Place
May 8	Nebraska	January	Baton Rouge, Louisiana; Athens, Ga.
May 19	Minnesota	April 20	A. & M. College, Mississippi
May 25	North Dakota	May 3	Drainland, South Carolina
		May	Arkansas
		June 6	Jefferson County, Illinois
		June 15	Iowa; Wayne County, Ohio
		June 16	Rice County, Minnesota
		June 26	Auburn, New York
		June 30	Delaware and Fond du Lac, Wisconsin
		June	Brookings, South Dakota
		July	Fort Collins, Colorado

The following comments from collaborators as to reasons for greater or esser amounts of rust and as to resistance in varieties, are of interest:

Louisiana: Very severe even on the local resistant varieties, non-resistant varieties were killed without heading. The actual loss in the state was not so great as a year ago because there was not so much seed shipped in for planting purposes. (Edgerton)
(Outside seed apparently less resistant than native.)

Arkansas: Late varieties more severely attacked. (Elliott)

Illinois: Mild winter allowed a great deal of volunteer oats which were, as a rule severely infected, to live over and serve as an inoculation source for the crop. (Tehon)

Wisconsin: White Russian type most resistant. Our new Pedigree No. 12.128 showed 4%; Forward, 8%; Pedigree No. 1, 10%. (Vaughan)

In Canada and also in a few localities in the United States numerous cases ere observed where infected Rhamnus was undoubtedly the source of inoculum for ats. Infection on this host was especially severe this year in North Dakota and askatchewan, as shown by the following reports:

North Dakota: The buckthorn hedges were severely attacked this year, more reports and specimens coming to us this year than have been received for many years. All specimens showed heavy infection, and represented localities in all sections of the state.
Crown rust was common, but no data on amount of infection are

available. Due to the irregularity of precipitation over the state, it is likely that heavy infection occurred in some fields and slight in others, similar to the wheat stem rust infections. (Weniger)

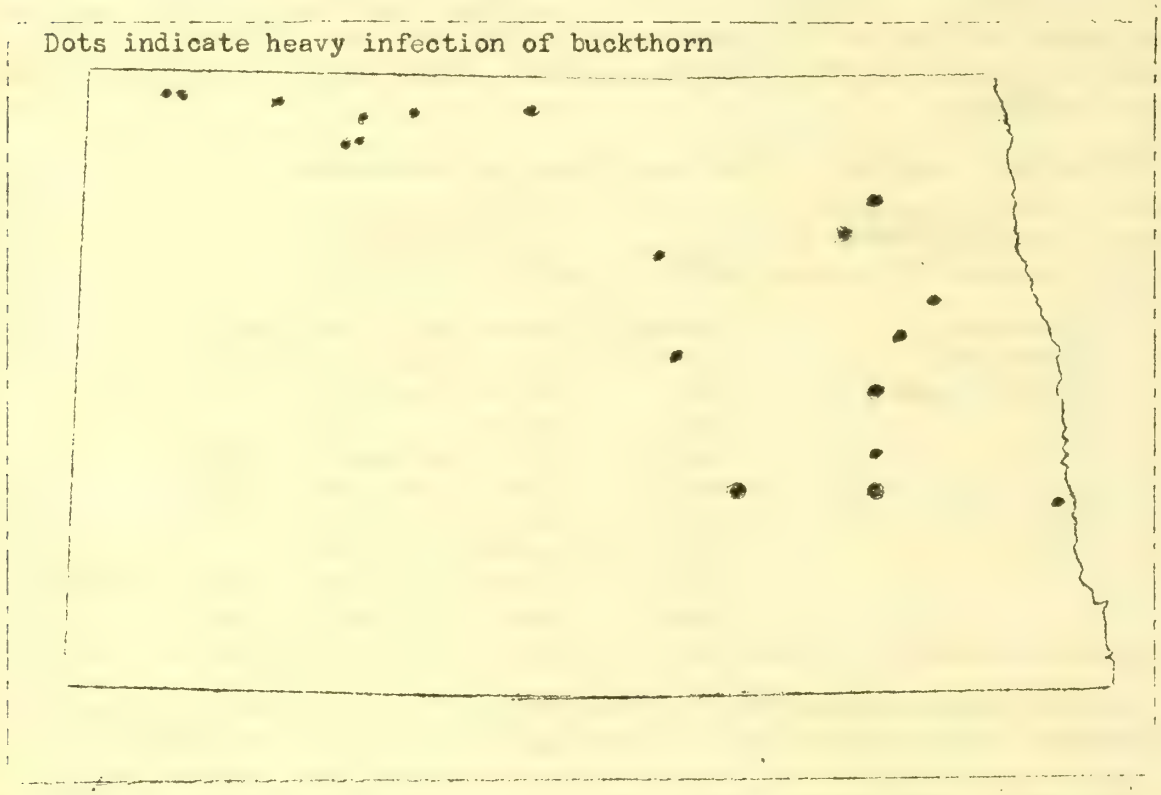


Fig. 32. Locations in North Dakota where heavy infection of crown rust occurred on buckthorn (1922), after map prepared by W. Weniger.

Saskatchewan: The aecial stage of this rust was very severe on Rhamnus carthartica in Southern Saskatchewan in early summer. It was so abundant that the buckthorns appeared yellow at some distance. It was present, but less severe, in the northern part of the province. The crown rust was very severe in Southern Saskatchewan, and extended northward as far at least as Saskatoon, but not nearly so severe as in the south. (W. P. Fraser.)

References

Melhus, I. E., S. M. Dietz and Florence Willey. Alternate hosts and biologic specialization of crown rust in America. Iowa Agr. Exp. Sta. Res. Bul. 72: 211-236. Jan. 1922.

Parker, J. H. A review of the literature on the rusts of oats, with notes on their distribution in the United States. Proc. Kansas Acad. Sci. 30 (51st-53d Ann. Meet.): 71-118. 1922.
Literature cited: p. 117-118.

Halo-blight caused by Bacterium coronafaciens Elliott (Pseudomonas avenae Manns)

The following states reported halo-blight: New York, Wisconsin, Minnesota, North Dakota, South Dakota, Iowa, Missouri, Arkansas, Idaho, and California. No losses of any consequence were recorded but in Minnesota and North Dakota the disease was more prevalent than usual. Weniger of North Dakota says it was especially prevalent early in the season at Fargo but seemed to be checked by a long period of hot, dry weather. From California, Mackie reports that the disease is carried on wild oats, Avena fatua. The attack in that state was slight but the disease was rather widespread, both in coastal areas and in the interior, especially in the Sacramento Valley.

The varieties Wisconsin 105, Wisconsin 108, and Sixty Day were reported susceptible in Minnesota, by the Section of Plant Pathology.

In a recent paper Charlotte Elliott (1) states that inoculation of oat panicles with a liquid suspension of B. coronafaciens did not result in any more sterility than when sterile water was used. It would appear, then, that this organism is not naturally an important factor in the cause of oat blast (See blast, page 230).

Reference cited:

(1) Elliott, Charlotte. Sterility of oats. U. S. Dept. Agr. Bul. 1058: Mar. 1922.

Blast (sterility) cause not determined

During the year seventeen states, ranging from New York to California and from Louisiana to Minnesota, reported losses from sterility. The following estimates of percentage reduction in yield were given: 15%, Ohio; 5%, Illinois and Kansas; 3%, Idaho; 2%, Arkansas; 1 1/2%, Louisiana, Iowa and South Dakota; 1/2%, New York, Minnesota and North Dakota. More blast than usual was reported from New York, Ohio, and South Dakota, but the other states mentioned the same, or average amounts.

During 1922 an important publication on sterility of oats (1) has appeared. In this paper it is demonstrated that spraying of plants with water at the time when the oats are coming into flower will result in sterility. The author concludes that it seems probable that rains falling about the time oats sheaths are ready to open may result in so much moisture that further development of the panicles is hindered.

Variations in susceptibility of varieties to sterility were noted by Elliott.

Reference cited:

(1) Elliott, Charlotte. Sterility of oats. U. S. Dept. Agr. Bul. 1058: 1-8. Mar. 1922.

Anthracnose caused by Colletotrichum cereale Manns

Only four states, Louisiana, Ohio, Wisconsin, and Minnesota, report traces of this disease on oats. In Minnesota it was first noted July 7 in Ramsey County, and in Wisconsin, July 15 at Madison. The state reporting the most anthracnose was Ohio where it was found in a number of fields, especially in the northern

section but the loss that resulted was slight. Negative reports were received from 18 states.

Scab caused by Gibberella saubinetii (Mont.) Sacc.

During 1922 scabbed oats were reported from the following states: New York (trace), Pennsylvania (one report from southeast), Delaware (less than last year, not noted as of any particular consequence), Kentucky (very slight importance), Ohio (very few scab infections have been observed or reported), Illinois (reported twice, certainly neither a serious nor generally encountered disease), Wisconsin (not seen except in experimental plots), Iowa (of no importance, trace loss).

From New Brunswick, Canada, G. C. Cunningham reports in the 1922 Survey of the Prevalence of Plant Diseases in the Dominion of Canada, that scab of oats was first noted as being of importance in fields on the experimental farm at Fredericton in 1920, where as high as 5% of the heads were infected. In 1922 it was observed in 5 fields out of 25 examined, averaging about 0.5 to 1%.

Miscellaneous diseases

Leaf spot caused by Helminthosporium sp. - reported from Minnesota (one report) and Idaho (not destructive).

Powdery mildew caused by Erysiphe graminis DC. W. W. Mackie in California reports powdery mildew as general in the coastal regions of the state, but not severe.

Speckled blotch of oats caused by Leptosphaeria avenaria Weber (= Septoria avenae Frank) was found near Madison, Wisconsin, in September 1921, occurring on volunteer oats at the University farm. This is apparently the first report for the United States. It has been reported previously from France, England and Germany (Weber, George F. Speckled blotch of oats caused by Leptosphaeria. In Septoria diseases of cereals. Phytopath. 12: 450-470. Oct. 1922).

Leaf spots, cause undetermined - reported from Montana, June 30, and from South Carolina, March 14.

CORN

Smut caused by Ustilago zeae (Beck) Ung.

Collaborators' estimates of losses from corn smut during 1922 are given on the accompanying map (Fig. 33). For the country as a whole the losses from this disease were less than during 1921, when it was unusually prevalent in many states. The majority of the states reported either the same amount as or less than last year, but in New England, New York, New Jersey, and Pennsylvania, and also in Iowa and North Dakota more smut than last year was reported. In South Dakota, where an epiphytotic causing a reduction in yield estimated at 15% was experienced in 1921, the disease was relatively unimportant this season, causing only a loss of about 1%.

R. S. Kirby in New York made counts of over a thousand stalks of Lewis Favorite at Mattituck, Long Island, and obtained the following results: Total percent stalks and ears smutted, 18.2 - percentage ears destroyed by smut, 3.3.

The weather and possibly other factors are quite important in influencing the amount of smut from year to year. From Wisconsinm Vaughan reports that more smut seems to occur in that state in seasons when dry weather comes early.

Fig. 33. Estimated percentages of losses from corn smut during 1922, according to collaborators.

Table 75. Dates of first appearance of corn smut 1922, according to collaborators.

May 23, Linn Co., Mo.	:July 1, Ramsey Co., Minn.	:July, Baton Rouge, La.
June 15, New Castle Co., Del.	:July 6, Laurel, N. Y.	:July, Fayetteville, Ark.
June 24, Meridian, Miss.	:July 10, Mt. Carmel, Conn.	:July, Wayne Co., Ohio
June, Sanford, Fla.	:July 29, Vermont	:July, Brookings, S. D.
July 1, Wayne Co., Ill.	:July 29, Clemson Coll., S. C.	:Aug., Fort Collins, Col.

A number of collaborators report considerably more smut in sweet corn than field corn. Other variations in susceptibility noted are as follows:

Kentucky: In self-pollinated lines marked differences are seen in susceptibility. Some lines are apparently free, others affected on certain organs, as tassel, ear, etc. (Valleau)

Kansas: Strains of corn are being developed that are found in our experimental work, to be highly resistant or susceptible. (Melchers)

Ohio: A few fields of Golden Bantam have shown 100% infection. Stowell's Evergreen, most generally grown throughout Ohio, shows only a nominal percentage. (Thomas)

Regarding the influence of fertilizer, Hoffer in Indiana reports more smut in thickly planted fertile fields. From Wisconsin the report comes that some are of the opinion that certain fertilizers make the plants more resistant.

Head smut caused by Sorosporium reilianum (Kühn) McAlp.

In 1922 this disease was only reported from the State of Washington where a field near Pullman showed a considerable amount of the disease and where occurrences were also noted in Yakima County. During the year the following publication has appeared describing the discovery of the disease on corn in Washington in 1919.
Parker, C. S. Head smut of corn in Washington. Phytopath. 11: 515. Dec. 1921.

Rust caused by Puccinia sorghi Schw.

Rust was reported from practically all states east of the 100th Meridian and from Colorado. It was also collected in Manitoba, Canada, according to the Canadian Plant Disease Survey. It was generally distributed in the states from which it was reported but the only region in which it was the cause of appreciable damage was the South. In Florida the disease was rather severe in a number of places, according to O. F. Burger. In Mississippi, D. C. Neal reported it as rather severe this season in many of the southern counties, especially on late planted corn, and not only were the leaf blades rusted, but the stalks were more or less stunted because of the disease. In Louisiana, C. W. Edgerton reported the disease as abundant but probably causing less injury than in 1921, and from Texas, Taubenhaus reports rust as prevalent probably causing 1% loss. No marked differences in varietal susceptibility were reported.

During the past year a paper by Weber (1) has appeared which gives the results of studies on spore germination, overwintering, infection, and susceptibilit

References
(Cited):
(1) Weber, G. F. Studies on corn rust. Phytopath. 12: 89-97. Feb. 1922.

(Not cited):
Maneval, W. E. Germination of teliospores of rusts at Columbia, Missouri. Phytopath. 12: 471-488. Oct. 1922.

Root and stalk rots caused by various organisms

It is very difficult to distinguish between root and stalk rots caused by species of Fusarium or Gibberella and similar diseases caused by Diplodia or other organisms. The following summary pertains particularly, however, to rots caused b Gibberella and Fusarium. These diseases were reported from practically all states in the eastern part of the country and locally in Montana and Idaho. The losses are extremely difficult to estimate with any degree of accuracy, on account of the confusion with other troubles and because of the difficulty in distinguishing diseased plants. The following comments from collaborators emphasize the difficulty in estimating losses.

Kentucky: There is nothing on which losses from root rot can be based. We need more information in regard to the nature of the disease before

estimating losses. So-called root rot losses are mostly overcome by soil treatment and plenty of moisture. All corn plants have numerous root rots and the extent of injury is dependent on soil fertility, moisture, etc. (Valleau).

Mississippi: It is difficult to estimate with any degree of accuracy the percentage of injury due to root rot, since other factors such as unfavorable soil conditions, bud worms, etc., complicate the percentage of loss in poor stands, lessened yields and the like. It is also practically impossible to distinguish infected stalks from healthy ones unless the plants are pulled up and the stalks split open. In other words, it appears under our conditions that slightly infected or moderately diseased stalks reveal about the same degree of vigor as healthy plants. (Neal).

Ohio: This disease is so closely interwoven with Diplodia that it is very difficult to differentiate the actual loss occasioned by each. (Thomas).

The following comments give information concerning the importance of the disease in the various states.

Delaware: Very important. Affected crowns and nodes. (Adams).

Maryland: Very prevalent in southern counties of the Eastern Shore this year. I have seen several fields in which 25-75% of the plants were infected. (Jehle).

New Jersey: Quite important. Generally distributed over the state but more severe in the southern part. (Dept. Pl. Path.)

Pennsylvania: Coming to be recognized as an important trouble on corn. Probably worse in the southeastern part of the state. (Thurston and Orton).

West Virginia: General, but resulting damage apparently not great, due to excellent growing season. (Giddings and Sherwood).

South Carolina: Cultures made last spring from seed corn showed some of these fungi but its importance in this state is not clear. Some varieties on test at the Station showed a certain amount of broken shanks but little other evidence of infection. (Ludwig).

Florida: On May 6 practically every plant in a 35-acre field was yellow and the margins of many leaves were drying out and brown. The owner applied nitrate of soda to 30 acres at the rate of 150 pounds per acre, in addition to other fertilizers. On August 31, counts were made on both the fertilized and unfertilized land. Where no nitrate of soda was used, 36% of the stalks were barren while only 18% were sterile where nitrate was used. (W. B. Tisdale).

Ohio: Less than last year. General but worse in southern and southeastern portion of the state. (Thomas)

Illinois: Present in serious quantities. Loss this year may be as much as 8%. (Tehon).

Minnesota: Local infections in southern part of the state. (Sect. Plant Path.)

Iowa: Of slight prevalence and doubtful importance. (Melhus).

Missouri: Damage varies from slight to severe. (Maneval).

Kansas: Present in all fields. The actual damage or injury which occurred this year is problematical on account of the drouth of August. (Melchers).

The following comments concern the value of seed selection and varietal susceptibility:

Connecticut: Seem to be worse on some of Jones' crossed varieties. (Clinton).

Delaware: Seed selection by germination has effectively culled out seed ears carrying disease, giving increased yields of 2-25 bushels per acre. (Adams).

Maryland: One yellow variety showed marked resistance. This has been selected for type for many years. Sixty tests for control by seed selection were made this year with an average gain in yield of about 10%. (Temple and Jehle).

New Jersey: Plantings of tested seed gave reduction in infection. (Dept. Plant Path.)

Virginia: Seed selection has been beneficial. (Fromme).

Illinois: The yearly increased average of disease-free seed tending to reduce the disease. (Tehon).

Ear rots caused by Fusarium spp.

Rotting of the ears associated with Fusaria is perhaps another manifestation of root and stalk disease, but for various reasons it seems best to report this trouble separately.

Maine: We occasionally see a case of Fusarium ear rot but Fusarium poae (Peck) Wr. is the only species that we have isolated from corn, mostly sweet corn. (W. J. Morse).

New York: At Mattituck, Long Island, 2100 ears of Luce's Favorite were examined in September. Of the large ears 24.3% had tip infection and 5.4% butt infection. Of these infected ears 95% were infected with Fusarium moniliforme and 5% with Gibberella saubinetii. (Kirby).

New Jersey: General but severe in the southern part of the state. Plantings of tested seed showed a reduction of infected stalks amounting to as much as 50%. (Dept. Plant Path.)

CORN - Ear rots

Pennsylvania: Present and doing considerable damage. (Thurston).

Delaware: Kernel rot with Fusarium moniliforme very prevalent and most destructive with ears infested with corn ear worms. (Adams).

West Virginia: Observed generally but worse in valleys. (Giddings and Sherwood).

Kentucky: Fusarium moniliforme causes kernel injury, especially on injured ears. Gibberella saubinetii seems to be most important as a cause of ear rot each year. (Valleau).

Mississippi: All of our seed corn shows a high percentage of Fusarium moniliforme. (Neal).

Louisiana: Seventy-five to 85% of the kernels show infection by Fusaria but the loss does not seem to be heavy in proportion. (Edgerton).

Indiana: Very slight damage this year from ear rot. No corn ear worms. (Hoffer).

Iowa: Moldy ear tips general. One percent estimated loss in the state. (Melhus).

Kansas: Fusarium moniliforme very prominent. Occurs on practically every ear. (Melchers).

Recent literature:

Adams, J. F. and T. F. Manns. The corn ear worm and kernel rot of corn. Phytopath. 12: 25-26. Jan. 1922.

Dry rot or ear mold caused by Diplodia zeae (Schw.) Lev.

As a result of the prevalence of Diplodia infection on corn in 1921 throughout the greater portion of the corn belt, a large percentage of seed corn contained diseased kernels with the result that a number of states this year, particularly Ohio and Iowa, report seedling blights and root rots of corn due to Diplodia. The attack of the ears of this year's crop by Diplodia was in general much less severe than last year. The disease was reported to the Survey from Connecticut, New York, New Jersey, Delaware, Maryland, West Virginia, Virginia, Kentucky, Mississippi, Louisiana, Arkansas, Ohio, Indiana, Wisconsin, Iowa, and Kansas. From Delaware, Adams reports much more of this disease than last year and states that it was the most serious corn trouble of 1922. In that state it appeared more prevalent in fields where corn had been topped, and by count as high as 9% infection was found in some fields. In Ohio, Thomas reported that the weather of August and September was unfavorable for the spread of Diplodia, and for this reason it is believed that seed corn will carry comparatively little of the fungus. The greatest loss in that state occurred through the planting of infected seed. Estimates of loss are as follows: New Jersey, .6%; Maryland, 1%; Ohio, 3-5%; Indiana, 3-5%; Iowa, 3%; Louisiana, 5-10%; Arkansas, trace, and Kansas trace.

CORN - Dry rot or ear mold, Bacterial wilt, Brown spot

Valleau in Kentucky noted very marked differences in the number of ears affected in selfed lines. Some lines appeared entirely free while others were nearly eliminated by ear rot.

The relation of dry rot to rainfall and temperature as well as other facts concerning the disease are brought out by Melhus and Durrell (1) in Iowa circular 78.

References
(Cited):

(1) Melhus, I. E. Dry rot of corn. Iowa Agr. Exp. Sta. Circ. 78. April 1922.

(Not cited);

Johann, Helen, James G. Dickson and Grace Wineland. Relation of environment to infection of corn seedlings by Diplodia zeae (Schw.) Lev. (Abstract) Phytopath. 13: 52-53. Jan. 1923.

Bacterial wilt caused by Aplanobacter stewartii (EFS) McCul.

Reports of bacterial wilt were received during the year from New York, Maryland, Virginia, Ohio, Indiana, Illinois, Missouri, Kansas, North Dakota, and Mississippi. It was reported most commonly from Virginia and Maryland westward to Illinois, in the sweet corn canning sections. The disease is particularly one affecting sweet corn although field corn varieties are sometimes attacked. All of the collaborators reporting on varietal susceptibility mention that the Golden Bantam is most affected, while other sweet corn varieties, like Stowell's Evergreen or Country Gentleman, are not so badly attacked. One and a half percent reduction in yield of sweet corn is reported in Maryland, and 1 to 5 percent in Virginia. Two cases in Illinois were noted where 25% loss occurred while in Virginia a case of 90% infection was observed, and in Maryland 50 to 60%. Dates of first appearance were as follows: Virginia, June 16; Ohio, June; North Dakota, July 25; Maryland, July; New York, September.

According to North Dakota collaborators the disease is a comparatively new one for the state, and was observed in only a few fields this season.

Brown spot caused by Physoderma zeae-maydis Shaw

Although brown spot occurred as far north as Ohio, Indiana, Illinois, Missouri and Kansas, it was of importance only in parts of the Gulf and South Atlantic States. In South Carolina about 1% reduction in yield was estimated and in Alabama .5%, Mississippi a trace, Louisiana 1-2%, and Arkansas a trace.

The dates of first appearance reported are: May, Arkansas; June 20, A. & M. College, Mississippi; June, Sanford, Florida; July 15, Clemson College, South Carolina; July, Ohio.

In Florida the statement is made that the disease was more serious in the northern and northwestern portions of the state.

CORN - Mosaic, Bacterial stalk rot

Mosaic

During 1922 mosaic on corn was reported to the Survey only from Arkansas by H. R. Rosen. The following is an abstract of a recent paper presented by Rosen at the Atlanta meeting of the southern branch of the American Phytopathological Society, February 20-22, 1922. (Phytopath. 12: 252. May 1922),

> "Mosaic disease of corn has been noted for two successive years in northeast Arkansas. Comparatively few plants were found attacked and of these only a small number were so seriously affected as to influence the production of normal ears. Badly diseased plants are very much stunted, due principally to a shortening of upper internodes, possess chlorotic spots and stripes in great profusion, and contain a compact group of shortened leaf-blades, presenting a rosette appearance, at the top of the plant. Such plants produce abortive ears only. Present observations indicate that under Arkansas conditions the disease is not as serious or as common as in the Hawaiian Islands."

Bacterial stalk rots

In a recent paper (1) H. R. Rosen has described and named the organism causing stalk rot of corn in Arkansas and certain other states. He has given it the name Bacterium dissolvens Rosen. The following report concerning 1922 developments was submitted to the Survey by Rosen on December 13, 1922:

> "Specimens of this disease have been received this year from several localities in Illinois and in Arkansas, with reports that about one or two percent of the corn had been found with this disease. Diseased material from other states which had been suspected as being of bacterial origin, when carefully examined proved to be due to agents other than bacteria. Recent studies conducted by the writer at the University of Illinois indicate that air temperature is an important factor in the inception and development of this disease and that this malady is to be looked for only in the warmer sections of the country.
>
> "The very thorough destruction of attacked tissues, as I have previously described (Phytopath. 11: 74-79. 1921), was again evident and serves as a good distinguishing character. The disease in Arkansas has not been as serious during the last two years as it had been in 1920, doubtless due to the lack of precipitation. I wish to call attention to the fact that Dowson, in East Africa, has described a bacterial disease of field corn, which, judging from his brief account, appears to be very similar to the Arkansas disease."

Bacterial stalk rots have also been reported during the past year from Ohio, North Dajota and Arizona. It is uncertain as to whether or not these are the same as the Arkansas disease. The reports follow:

> Ohio: A more general distribution of bacterial disease of corn seems to occur this year. A limited number of cases were found during both seasons of 1920 and 1921. The causal organism is as yet undetermined. (Dept. of Botany, July 1, 1922).

CORN - Bacterial stalk rot, leaf blight.

North Dakota: A bacterial rot of field corn has been noticed for the first time in such quantity as this year. In the Fargo region, and also in many separate fields near Dickinson, the trouble I noticed was conspicuous and had attacked about 2% of the plants. The plants appear yellow, and the stalk dwarfed, rotted with a soft rot which extends from near the ground line to include the undeveloped tassel. (Weniger).

Arizona: The two plants sent in from Maricopa County by D. C. George show a bacterial stem and root rot corresponding to the description published by Rosen in an Arkansas Exp. Sta. Bul. George states that only an occasional plant shows the disease. (J. G. Brown, Aug. 1).

Reference

(1) Rosen, H. R. The bacterial pathogen of corn stalk rot. Phytopath. 12: 497-499. Oct. 1922.

Leaf blight caused by Helminthosporium turcicum Pass.

Connecticut, New Jersey, Delaware and Florida reported leaf blight during 1922. In Connecticut it was epidemic and was the worst corn disease of the year, causing an estimated loss of about 2%, according to G. P. Clinton. It was also important in New Jersey and Delaware. The heavy rains of June and July are thought to be responsible for the unusual outbreak of this disease in the North Atlantic coast states. The following statement by W. D. Valleay of Kentucky is of interest in this connection:

"Some time ago in one of the Survey reports, there was a request made for information on the Helminthosporium leaf disease of corn. I have nothing to report with regard to damage under field conditions as it apparently caused little this year, but the past summer I made some further detailed studies of seed infection in corn and determined that Helminthosporium sp. was carried in some seeds of 13 out of 15 ears studied. I have also very strong evidence that it has been present in numerous other ears that I have studied during the past three years, but I have never up to this time positively identified the organism as Helminthosporium, as under the previous conditions it did not fruit. However, it is generally the organism which causes the coal black spots or streaks in the seed coats of corn when they are grown either on sterile sand or in soil. If the plant is left in sand until death occurs, and then is allowed to remain in a few days longer, the organism, if present, will usually fruit abundantly on the seed coats, and if it has caused the death of the plant, may also fruit on the stem, between the cotyledonary node and the first node. To what extent it is the cause of the slight amount of seedling blight which occurs under field conditions, I am unable to state."

CORN - RICE - Miscellaneous

Miscellaneous diseases

Anthracnose caused by Colletotrichum graminicolum (Ces.) Wils. More abundant than usual in Connecticut, not a serious trouble, however. Reported first July 14 from Milford.

Purple sheath spot as described by Durrell (Phytopath. 10: 54-55. Jan. 1920) reported from Connecticut, Arkansas, North Dakota and Kansas. In North Dakota it seemed more conspicuous in some varieties and selections than others, according to Weniger.

Leaf spots, cause undetermined, were reported from South Carolina and Michigan.

Yellow speck, cause unknown - very common and doing some injury to the leaves of corn in Connecticut, also collected in Pennsylvania.

Blackened cob caused by Cladosporium sp. - reported on imperfectly fertilized or cured ears in Connecticut.

Black mold caused by Aspergillus niger Van Tieghem. Quite prevalent in Texas, according to Taubenhaus.

Reference:

Weston, Wm. H. Jr. The production of conidia at night in species of Sclerospora. (Abstract) Phytopath. 12: 34. Jan. 1923.

RICE

Adapted from map by O. E. Baker (A graphic summary of American agriculture. U. S. Dept. Agr. Yearbook 1921: 407-506. Tobacco, rice, flax and hemp acreage, 1919, p. 446).

Fig. 34. Rice-growing areas of the United States.

Straighthead (non-parasitic) was reported from South Carolina - "(Beaufort County); important in restricted areas. Same grower who reported injury last year reported it again this year - this time on land recently rested." (Ludwig); Louisiana - "Very common; worst in southwestern part" (Edgerton); "(Brazoria and Jefferson Counties); prevalent, loss 5% (Taubenhaus); and Arkansas - "Scattered; 50% of fields in state infested, some fields badly injured (30%); total loss 2%".(Elliott).

Blast caused by Piricularia oryzae Br. & Cav. - South Carolina (one case of slight damage in Beaufort County somewhat doubtfully placed here - Ludwig); Louisiana (common, 1 to 2% loss - Edgerton); Texas (trace - Taubenhaus); Arkansas (of no economic importance, trace - Elliott).

Foot rot caused by Rhizoctonia sp. - Arkansas (severe in some fields; 1% loss; farmers say it becomes severe in some fields after a few years, reducing the yields 50 to 60% at times, or more - Elliott).

Recent literature on diseases of rice:

Sclerotium sp.

Braganca Pereira, E. de. Sclerotium disease of rice. Philipp. Agr. 10: 331-345. Feb. 1922.

Thompstone, E. and A. M. Sawyer. The "gwabo" disease of paddy. Bul. Dept. Agr. Burma 1920. No. 16. 12 p. 1922.

Helminthosporium sp.

Nisikado, Y. and Miyake, C. Studies in the Helminthosporiose of the rice-plant. Ber. Ohara Inst. Landw. Forsch. 2: 133-195. pls. 3-9. 1922.

Ocfemia, G. O. Helminthosporium disease of rice. (Abstract) Phytopath. 13: 53. Jan. 1923.

Experimental work on disease formerly called "Sesame spot disease of rice," caused by Helminthosporium oryzae Breda de Haan.

Sundaraman, S. Helminthosporium disease of rice. Bul. Agr. Res. Inst. Pusa 128. 7 p. 1922.

Fungus is a weak parasite under normal conditions; and disease unimportant.

Miscellaneous

Shaw, F. J. F. A diseased condition of rice. Agr. Jour. India 17: 152-154. Mar. 1922.

A diseased condition of paddy, somewhat resembling straight-head, has been shown to be dependent upon a deficiency in the supply of oxygen to the roots.

Tisdale, W. H. Seedling blight and stack-burn of rice and the hot-water treatment. U. S. Dept. Agr. Bul. 116: 1-11. Nov. 1922

Due to various fungi; most promising method of control is the development of resistant strains and varieties.

FLAX

Rust caused by Melampsora lini (Pers.) Desm.

The accompanying map (Fig. 35) indicates the distribution of flax rust, as far as it can be determined from available data.

In 1922 flax rust was reported from Wisconsin, Minnesota, North Dakota, Ontario, Prince Edward Island, and Saskatchewan. The losses caused were estimated in Wisconsin and Minnesota at a trace, and in North Dakota at 1%. The disease was severe in some fields in North Dakota, but a long period of dry weather prevented it from becoming generally serious, according to Brentzel. In Wisconsin the disease was said to be very late in developing, and Brentzel states that it appeared somewhat later than usual in North Dakota also. The dates and places of first observation reported are: July 7, Goodhue, Minnesota; July 10, Fargo, North Dakota;

North Dakota; July 28, Madison, Wisconsin.

•: Counties from which rust has been reported on cultivated flax to the Plant Disease Survey, 1904-1922.
R: Reported on cultivated flax to the Plant Disease Survey, locality not given.
A: On Linum usitatissimum,(J. C. Arthur, N. Am. Fl. 7^2: 101-102. 1907)
(A): On Linum spp.(Arthur), l. c.)
+: On Linum spp., counties (Patterson, Diehl, & Cash, U. S. D. A. Circ. 195. 1922).
*: Dominion Plant Disease Survey Annual Reports

Fig. 35. Distribution of flax rust in the United States and in Canada.

In Minnesota the variety NDR #114 is said to be susceptible to rust, while Minnesota 25 is resistant, and "Argentina" immune. Brentzel reports that "Many varieties show rust infection, including many that are resistant to wilt." The following report has been supplied by H. D. Barker:

"Flax rust was reported July 7 from Goodhue County, Minnesota. Following this date it was reported from several other localities in the state. For the first time in the history of the Plant Disease Survey, flax rust was general throughout Minnesota. Usually the disease occurs quite commonly in the Red River Valley, but outside of this limited section near the border of Minnesota and North Dakota extending into the northeast corner of South Dakota, it has not, at least since I have been working on flax rust, been found to occur very abundantly. This year, however, it was general through-

out the state wherever flax was grown. In a great many fields in widely different sections of the state it appeared in epidemic form. In some fields in which it occurred quite early, much damage was done to the plants - a number of them appeared to be stunted or killed outright by the rust where it became severe.

"On a survey trip through North Dakota rust was found to be quite heavy around Fargo, extending westward throughout the state as far as Mandan. In the region of Mandan it was, however, not so severe as it was in the more humid eastern section, although it seemed to be quite generally distributed. These reports were made for the most part on seed flax types. All of the fibre varieties which were noted in the state were rusted. The damage done to fibre flax is probably greater than that occurring on seed flax, since the rust damages the quality of the fibre produced. On the seed flax, unlessit appears in epidemic form, causing such damage as is noted above, it probably does not cause severe injury. Most of the seed flax types showed varying degrees of susceptibility. Winona, Minnesota No. 182, which is also resistant to wilt, and Primost, Minnesota No. 25, were both highly resistant. The only entirely immune variety found was Argentine, a large-bolled seed flax. A large number of varieties of both seed and fibre flaxes have been tested for resistance at stations in Minnesota and in North Dakota. All of these, with the exception noted, showed varying degrees of susceptibility." (February 3, 1923).

Adapted from maps in

1. Baker, O. E. A graphic summary of American agriculture. U. S. Dept. Agr Yearbook 1921: 407-506. (Tobacco, rice, flax, and hemp acreage, 1919, p. 446).

2. Finch, V. C., and O. E. Baker. Geography of the world's agriculture. Contribution from U. S. Dept. Agr. Office of Farm Management. 1917 (World acreage in flax, p. 57).

Fig. 36. Flax-growing areas in the United States[1] and in Canada[2].

Wilt caused by Fusarium lini Bolley

The distribution and importance of flax wilt are indicated in the following comments of collaborators:

Wisconsin: No flax diseases have been seen or reported outside of our pathological garden where a small amount of wilt was found. (Vaughan).

Minnesota: General. Slightly less than last year, same as usual. Seventy-five percent of the fields in state affected, 30% in some fields. Reduction in yield 5%. (Sect. Plant Path.)
Iowa: Not important. (Melhus).
North Dakota: Less than usual, less than last year. General on old lands, particularly in the eastern part of state. Light infection except in certain fields. In some late sown fields the crop was almost a total loss. Lightness of infection probably due to weather conditions and stage of maturity. (Brentzel).
South Dakota: Unimportant, trace. Some local damage. Occasionally on old ground with strains not wilt resistant. (Evans).
Saskatchewan: Not general. Very severe in some fields in the southern part of the province. (W. P. Fraser, in Survey of the prevalance of plant diseases in the Dominion of Canada, 1922).

According to Jones and Tisdale (1), the minimum soil temperature for the development of this disease is about 14°C. (57.°F.), the maximum 38°C. (100.4°F.), and the optimum about 24° to 28°C. (75.2° to 82.4°F.) They state also that the usual midsummer temperature in North Dakota corresponds closely to the optimum for flax wilt. In this connection it is worth noting that the average July air temperature in both North Dakota and Minnesota in 1922 were below the normal for the month, and also below the average for July 1922. (Table 76).

Table 76. Comparison of normal July temperatures in North Dakota and Minnesota with the averages for 1921 and 1922.

State	July temperatures (°F)		
	Normal	Average 1921	Average 1922
North Dakota	67.5	71.4	65.6
Minnesota	69.0	74.2	67.3

Literature cited:
(1) Jones, L. R. and W. B. Tisdale. The influence of soil temperatures upon the development of flax wilt. Phytopath. 12: 409-413. Sept. 1922.

Heat canker (non-parasitic)

Heat canker was apparently of slight importance in 1922. It was reported from Minnesota and North and South Dakota.

Reference: Reddy, C. S. & Brentzel, W. E. Investigations of heat canker of flax. U. S. Dept. Agr. Bul. 1120. 1-18. Oct. 1922.

New diseases

A new disease (1) of flax, similar to if not identical with one called "pasmo" in South America, caused by Phylctaena linicola Speg., has been observed to a limited extent in North Dakota for the past four years, and during the past season was found on fiber flax in Michigan. Artificial inoculations indicate that varieties differ considerably in susceptibility to this disease.

Another new disease, apparently caused by a species of Rhizoctonia, has been distinguished in eastern North Dakota (2). In the fields in which it occurred, practically every flax plant in somewhat definitely limited areas of varying

size was infected. The disease is destructive where it has been observed. Inoculation experiments reproduced the disease on flax but not on other plants. Minimum, optimum, and maximum growth temperatures in culture have been found to be about 13, 26, and 35°C., respectively.

Literature (Cited):

(1) Brentzel, W. E. A disease of flax not previously reported in the United States. (Abstract). Phytopath. 13: 53-54. Jan. 1923.

(2) _____ Disease of flax caused by a species of Rhizoctonia. (Abstract). Phytopath. 13: 53. Jan. 1923.

SORGHUM

Covered kernel smut caused by Sphacelotheca sorghi (Link) Clinton

Covered kernel smut was reported from Wisconsin, Kansas, Texas, Colorado, and Arizona during 1922. In Kansas, according to Melchers, it was common in fields where seed treatment was not practiced, the percentage of heads destroyed ranging from a trace to 50%, depending on the variety and conditions at planting time. The disease was prevalent in that state and also in Texas and Arizona. Varietal resistance is reported on from Wisconsin as follows:

> "Northern Amber strains apparently free from smut. Iowa Amber showed considerable. Orange Cane usually smutted. Local varieties mostly grown, hence little lost. Formalin treatment cleaned out smut on Iowa seed." (Vaughan).

Control studies being conducted in Kansas are summarized below by Melchers:

> "Extensive studies are being made of the various treatments for the control of sorghum-kernel smut. Sprghum-smut treatment plats are located in 15 different counties in Kansas. Some of these fungicides are: Chlorophol, Seed-O-San, and the Corona mercuric bichloride products. Similar studies are being made on oat smut."

Other diseases

Loose kernel smut caused by Sphacelotheca cruenta (Kühn) Potter - Reported by Taubenhaus from Texas as prevalent.

Head smut caused by Sorosporium reilianum (Kühn) McAlp. Reported from Minnesota (very serious in Waconia section where most of sorghum in state is grown, Kansas (not common, but occurring occasionally on Red Amber, a variety which seems to be most susceptible. Soils once infested seem to perpetuate the disease from season to season - Melchers), and Arizona (very rare, one head collected near St. Johns).

Blight caused by Bacillus sorghi Burr. was reported in Louisiana (common as usual), Arkansas (rather common everywhere, 1-2% reduction in yield), Wisconsin (noticeable in all fields, especially all during seedling stage. The plants seem

to recover, of minor importance), Iowa (not important), and Kansas.

Regarding this and similar diseases of sorghum, L. E. Melchers writes as follows:

> "This spot which has been thought to be caused chiefly by Bacillus sorghi is extremely common on most varieties of sorghum. Causes most injury on Sudan grass. Other varieties not materially injured. There are apparently other factors than B. sorghi concerned in the spotting of sorghum."

A decay of the stalk of sorghums was noticed this season in Kansas and reported by Melchers as follows:

> "A similar trouble has been noticed other seasons in the western part of the state. Cultural studies have given a species of Fusarium. No inoculation work has been done to prove the pathogenicity of the organism obtained. So far this trouble has not been common."

Anthracnose caused by Colletotrichum sp. Noticed on the lower leaves in a small patch of broom corn at Morgantown, West Virginia, by John L. Sheldon.

Recent literature

Kulkarni, G. S. Conditions influencing the distribution of grain smut (Sphacelotheca sorghi) of jowar (sorghum) in India. Agr. Jour. India 17: 159-162. Mar. 1922.

Rumbold, Caroline and E. K. Tisdale. Phoma insidiosa on sorghum. Phytopath. 11: 513-514. Dec. 1921.

DISEASES OF FORAGE CROPS

A. LEGUMES

ALFALFA

Leaf spot caused by Pseudopeziza medicaginis (Lib.) Sacc.

Vermont, New York, New Jersey, and Pennsylvania report more leaf spot than average this year, while in the other 19 states that have reported the disease it was prevalent in about the usual or slightly less than usual amounts.

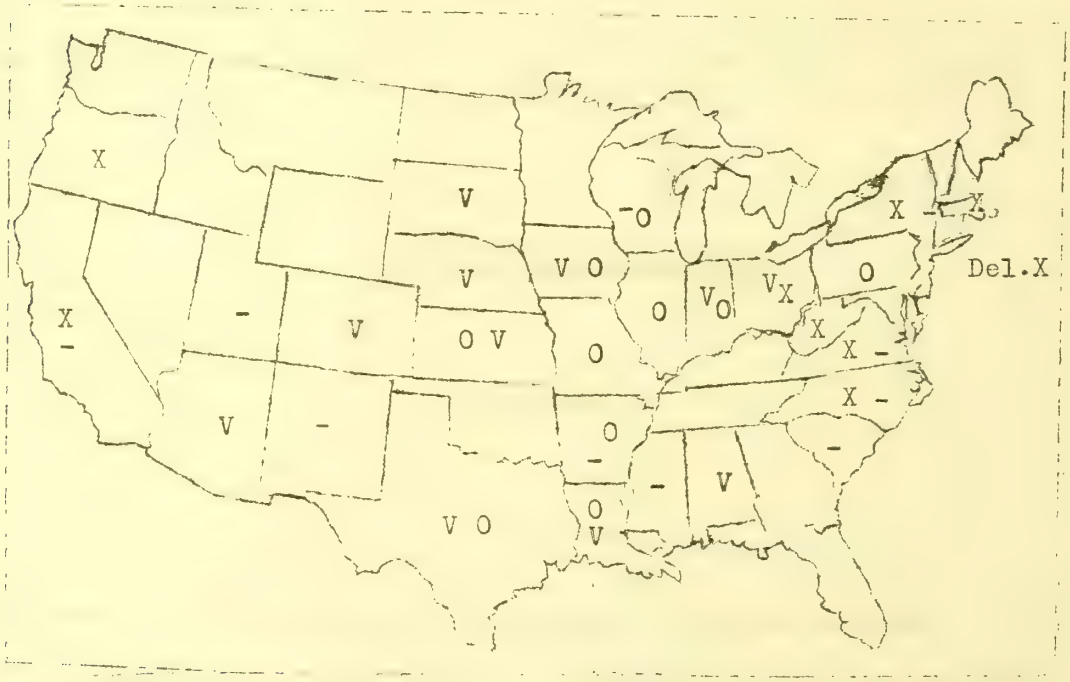
That it did some damage due to the shedding of the leaves is shown by the following estimates of losses: Vermont, 2-5% loss; Illinois, 5%; Iowa, 5%; and Missouri, 70% of the foliage destroyed in one case. The following are the dates of first appearance, according to collaborators:

April 11 - - - Virginia	June 29 - - - Minnesota
May 15 - - - - Missouri	June (late) - Ohio
May 23 - - - - Delaware	July 7 - - - Connecticut
June 15 - - - Vermont	July 18 - - - Mississippi
June 17 - - - North Dakota	July 21 - - - Indiana
June 18 - - - Pennsylvania	

Two interesting notes on control measures were reported. In New York one farmer dusted his alfalfa with sulphur and reported much greener foliage, while in Wisconsin R. E. Vaughan reported the disease as not serious where ample amounts of lime have been used in the preparation of the soil.

Hardigan alfalfa is described from Michigan (Mich. Sta. Quart. Bul. 4: 74-75 1922) as a new, hardy, disease-resisting variety developed at the experiment station as a result of 16 years breeding work. When leaf spot defoliated alfalfa in 1914 this strain was able to reset leaves on its stem and produce seed, whereas other strains sent up new growth from the roots and produced only vegetative growth

Rust caused by Uromyces striatus Schroet. = (Uromyces medicaginis Pass.)



V: Uromyces medicaginis on Medicago sativa L. according to J. C. Arthur*
-: " " " " " " "past Survey repor
O: " " " " " " " 1922 " "
X: " " " Medicago lupulina L. " " J. C. Arthur

Fig. 37. Occurrence of Uromyces striatus (U. medicaginis) in the United States (*N. Am. Fl. 7: 256-257. Apr. 15, 1912)

ALFALFA - Rust, Yellow leaf blotch, Other diseases

The accompanying map shows the states from which alfalfa rust has been reported. It will be noted that during 1922 the states of Pennsylvania, Illinois, and Missouri reported the disease to the Survey for the first time. In Indiana this year it occurred in much greater amounts than usual in the central and northern parts of the state, where E. B. Mains found it very abundant in the fall and considered it as especially bad in 1922. In Missouri it was unusually abundant on the farm crops plots at the University of Columbia, and from Kansas, Melchers reported that the outbreak was the most severe one that has ever been noticed. Considerable loss was reported from Louisiana, in which state the disease is usually prominent, and in Arkansas considerable damage resulted from the shedding of leaves.

Yellow leaf blotch caused by Pyrenopeziza medicaginis Fckl.

This disease was reported during 1922 only from New York, Wisconsin, Idaho, and Washington. Idaho is the only state reporting it as being the cause of any particular damage and, even in that state, the losses were not appreciable.

Other diseases

Anthracnose caused by Colletotrichum trifolii Bain. -Less anthracnose than last year was reported from Arkansas but it was of greater prevalence than during the average season in that state, being severe in the early spring and causing an estimate in loss of about 5%, according to Elliott. From Mississippi it was reported in 1922 by D. C. Neal as follows: "The disease is very serious and in many fields the percentage of infection is high. The trouble is also complicated with other factors, such as girdle, hopper injury, and perhaps other fungi. The anthracnose fungus, however, is constantly present."

Bacterial blight caused by Bacterium medicaginis Sackett.- Reported from the southern irrigated sections of Idaho by C. W. Hungerford. It was prevalent in about the same amounts as usual and was not very serious.

Downy mildew caused by Peronospora trifoliorum de Bary - During 1922 downy mildew was reported from New York, South Carolina (unimportant), Wisconsin (seen in many fields but doing little damage), Minnesota (one report of light infection), Missouri, Kansas (quite common on first crop but no particular injury; favored by wet spring), Colorado, Arizona, Idaho (found in irrigated section for the most part), and Washington.

Root rot caused by Sclerotinia trifoliorum Eriks. - Virginia, Idaho and Oregon report this root rot during 1922. The Canadian Plant Disease Survey reports the occurrence of the disease in British Columbia, but no new infected areas were determined. Only slight amounts were recorded in Virginia and Idaho, but in Oregon it was reported by Barss as serious in the southern part of the state and in Malheur County; serious damage was done in some fields in the early spring. Barss writes: "Estimated damage in Josephine County last spring was 5%; average on 4000 acres of clover and alfalfa in Malheur County is reported as 50% by the county agent." (See also clover, page 253).

Root rot caused by Ozonium omnivorum Shear - Texas and Arizona are the only states reporting damage to alfalfa from this cause. In Texas it occurred especially in irrigated fields of the Rio Grande valley.

Crown wart caused by Urophlyctis alfalfae Magn. - no reports of this disease have been received from any of the states during the past year. The following publications have recently appeared:

Jine, J: A note on the biology of the "crown-gall" fungus of lucerne. Proc. Cambridge Phil. Soc. 20: 360-365. My. 1921.

Guyot. Notes de pathologie végétale. Bul. Soc. Path. Vég. France 8: 132-136. Feb. 1922.

Bottomley, A. M. Note on Urophlyctis alfalfae on lucerne. Jour. Dept. Agric. Union South Africa 4: 153-155, 1922. The disease caused by Urophlyctis alfalfae on lucerne. Jour. Dept. Agric. South Africa 4: 153-155, 1922. - The disease caused by Urophlyctis alfalfae is described and its economic importance discussed in view of the restrictions recently imposed on the importation of lucerne seed into the Union. E. M. Doidge.

White top or yellows cause undet. - reported from Montana, Idaho, and Washington. Montana: "Very prevalent in first crop in some sections. Cause of much uneasiness; seems to be combination of environmental conditions prevalent during spring and early summer which unquestionably aggravated this trouble." H. M. Jennison. Idaho: "Fairly common; isolated plants in field affected; evidently a non-parasitic condition." - C. W. Hungerford, Idaho. In a recent bulletin from the U. S. Dept. of Agriculture (Oakley, R. A. and H. L. Westover. How to grow alfalfa. U. S. Dept. Agr. Farmers Bul. 1283: 1-36. Dec. 1922) Yellowing is listed as one of the most serious of all alfalfa troubles in the country.

Leaf spot caused by Pleosphaerulina briosiana Pol.- Collaborators in Georgia Missouri, and Kansas report this leaf spot. From Georgia, J. H. Miller reports as follows concerning the disease; specimens of which were determined by F. R. Jones of Cotton, Truck and Forage Crop Disease Investigations: "This disease has been reported from several counties and has been most serious in all alfalfa fields on the College of Agriculture Farms. Its ravages were equally as serious as with the Pseudopeziza leaf spot. Its attacks were much worse on the first two cuttings than on the present cutting; so repeated cutting and taking the crop off the field seems to be the only effective means of control." (August 1)

Leaf spot caused by Ascochyta medicaginis Bres. - reported from Missouri by Hopkins as follows: "About five specimens of this disease have been received, but it does not appear to be doing any damage."

Leaf spot caused by Macrosporium sp. - reported only from Louisiana (abundant as usual in some cases causing severe defoliation, spots as a rule following insect punctures - Edgerton), and from Missouri (one report, loss slight - Maneval).

Leaf spot caused by Cercospora medicaginis E. & E. - traces of this disease were reported from Texas and Missouri.

Violet root rot caused by Rhizoctonia medicaginis (DC.) Tul.- reported from Iowa (more; serious locally - Melhus), and Kansas (apparently not any more prevalent than in other seasons. Most conspicuous in old fields along river valley and creek bottoms - Melchers).

Root rot, cause undet. - an unknown root rot is reported by C. D. Learn from Colorado as important, and from Idaho, C. W. Hungerford writes: "Reported from nearly every part of state where alfalfa is grown. It is becoming more prevalent each year. A species of Fusarium has been quite constantly isolated from diseased plants."

Root knot caused by Heterodera radicicola (Greef) Müll. - reported from Texas by Taubenhaus who states that the variety Hairy Peruvian is highly resistant.

Dodder (Cuscuta spp.) - reported from Texas, Washington and Arizona.

Girdle (cause undet.) - the following paper on this disease has appeared during the year:

Brown, J. G. & Frederick Gibson. Some observations on alfalfa girdle. Phytopath. 12: 188-190. April. 1922.

CLOVER

Powdery mildew caused by Erysiphe sp.

Probably the most noteworthy plant outbreak of the year was that of powdery mildew of red clover. In 1921 it appeared in unprecedented amounts in states in the northeastern quarter of the country, but during 1922 it was much more widely distributed and occurred all over eastern United States from South to North and in eastern Canada. The accompanying map shows the geographical range of the disease. On the western limits it was reported only from the eastern parts od the Dakotas and Kansas. Apparently, it did not extend beyond the line of the 100th meridian.

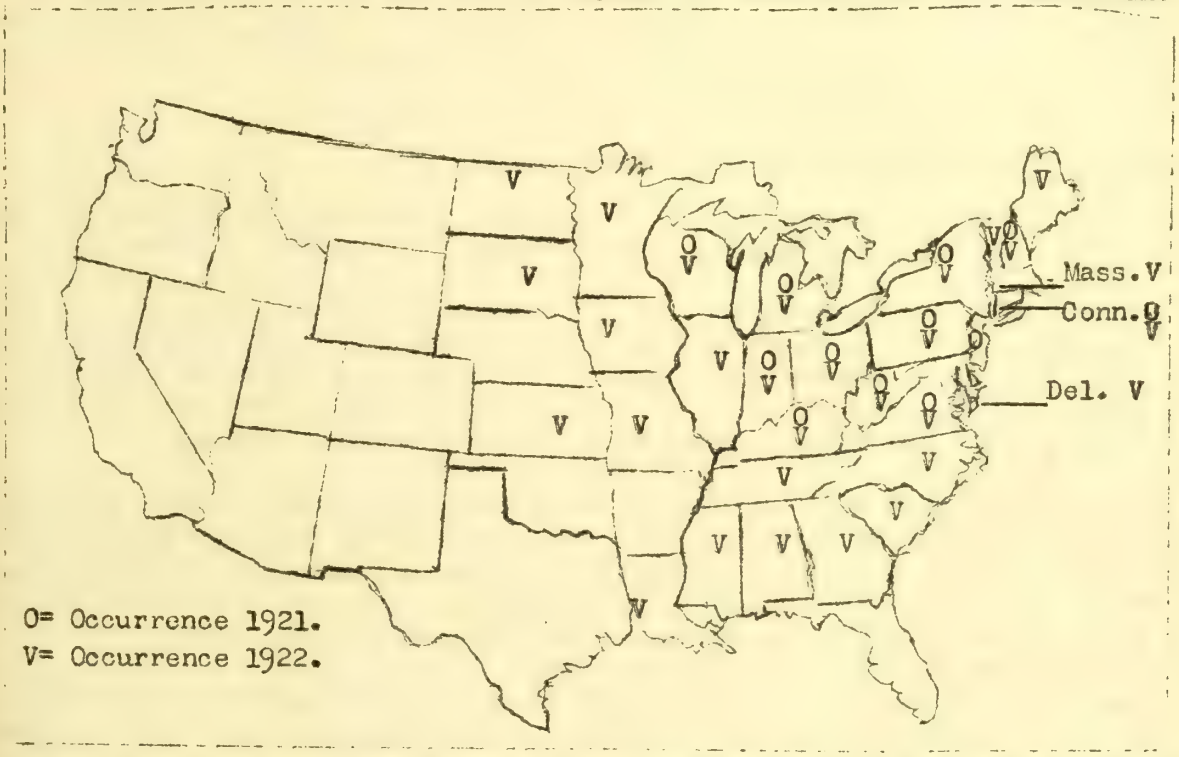


Fig. 38. Distribution of powdery mildew of clover in the United States, as reported by collaborators of the Plant Disease Survey, 1921 and 1922.

It appeared first in the southern states early in April and then as the crop developed, was reported farther northward appearing in the northern states during June. Whether or not this progression from south to north indicates spread in the same direction is uncertain. It is more probable that the fungus was well distributed and made its first appearance in the various places at the time when weather conditions favored. However, considerable spread undoubtedly took place during the year. A number of collaborators mention the appearance of the mildew in a portion of a state, with subsequent appearance in other parts.

The reasons for the unusual outbreak of this disease during the past two years is still somewhat in doubt. It may be that peculiar climatic conditions have favored the unusual development and spread of a native powdery mildew. On the other hand, there are good reasons to suppose, particularly on account of the conspicuous character of the mildew, its apparent invasion of new localities, and because of the fact that our native clovers are susceptible, whereas European ones

are resistant, that we have to deal with an introduced parasite which has found conditions especially favorable in the United States.

Statements concerning the losses and conditions in the individual states have already been made available (1 and 2). For the most part the actual loss was probably not large, but undoubtedly there was considerable reduction in yield in many fields on account of stunting of plants and shattering of leaves. Considerable alarm was manifested by farmers in many localities on account of possible injury to stock that was fed mildewed clover hay. However, no actual cases of stock poisoning from this cause were found and feeding experiments conducted with horses, cattle, sheep and swine at the Tennesseee Experiment Station resulted in no harmful effects.

Dates of first appearance of powdery mildew, 1922.

April 10.....	Louisiana	June 1	Union Center, Wis.
April	Fayetteville, Ark.	June 6	Wayne Co., Ohio
May 1	Rome	June 7	Rice Co., Minn.
May 11	Bedford, Va.	June 10	Orange Co., N. Y.
May 15	Southern Indiana	June 13	E. Spartanburg, S.C.
May 18	Poplar Bluff, Mo.	June 15	New Haven, Conn.
June	Delaware	June 15	Doniphan Co., Kans.
June 1	East Kingston, N. H.	July (early) ..	Vermont

The correct name for this mildew still remains in doubt, since the perithecial stage does not seem to have been collected during the past two years. The perfect stage of Erysiphe polygoni DC. has been collected on red clover in a number of the western states and in West Virginia and possibly other states in years past. However, it is not unlikely that the present organism is another mildew or another strain of the same species.

American red clovers and the mammoth or sapling clover are the varieties that are most universally attacked. It was seen on alsike clover by collaborators in New York, West Virginia, Pennsylvania and Wisconsin, but this host was very slightly and only rarely infected. White clover was also found affected in West Virginia by John L. Sheldon. According to him it was not common near Morgantown, but often present, especially when near red clover.

The following comment by Joan Monteith and the table by E. B. Mains, giving results of varietal tests at Lafayette, Indiana, shows that the American red clovers at Lafayette are susceptible, whereas those from Europe and Chile are immune or resistant:

> "There is marked resistance to mildew shown in the European clovers as compared with our home grown stock. This has been true in every one of Dr. Pieter's plantings that I have visited. This should not, however, be reported in a way that would give the impression that the foreign stock is therefore to be desired. Our home grown stock appears to be more resistant to anthracnose in some cases, is more hardy in northern sections and seems better able to stand the summer conditions farther south. So the factor of resistance to mildew is outweighed by other objections to their general use."

CLOVER - Powdery mildew

Table 77. Susceptibility of clovers to powdery mildew, Lafayette, Indiana, Oct. 12, 1922 (To be published in Proc. Ind. Acad. Sci. 1922) by Dr. E. B. Mains.

Species and variety	Original source of seed.	No. plants examined	Degree of susceptibility (no. plants)			
			Heavy	Moderate	Slight	None
Trifolium pratense 2019	S. Dakota	44	13	22	9	0
" " 2020	Ohio	44	9	15	19	1
" " 1809	N. Dakota	9	2	0	7	0
" " 2055	Chile	17	0	1	16	0
" " 1819	Italy	10	0	0	8	2
" "	France	44	0	0	15	29
" " 43592	England	10	0	0	0	10
Trifolium incarnatum 2054		10	0	0	0	12
Trifolium hybridum 2047		12	0	0	0	12
Trifolium repens 48625	Holland	8	0	0	0	8
" " 1928	Wisconsin	10	0	0	0	10
" " 1912	Idaho	25	0	0	0	25
" " 48019	England	12	0	0	0	12
Trifolium subterraneanum 51212		10	0	0	0	10
Trifolium fragiferum 29012		12	0	0	0	12
Trifolium reflexum 03308		12	0	0	0	12

Seed obtained from Dr. A. J. Pieters, Office of Forage Crop Investigations, U. S. Department of Agriculture. Numbers are those used by that Office.

CLOVER - Rusts, Root rots

Rusts caused by Uromyces spp.

Uromyces fallens (Desm.) Kern was reported on red clover from New England, West Virginia, Kentucky, South Carolina, Ohio, Indiana, Illinois, Missouri, Wisconsin, Minnesota, North Dakota, Idaho, and from Alberta and Manitoba, Canada. The disease is not destructive, but the combination of rust and powdery mildew undoubtedly caused some damage. In Kentucky, Valleau noted certain red clover plants on October 3 that were heavily infected with rust, while neighboring plants were entirely free. From Idaho, Hungerford writes that one field near Parma was severely attacked.

Uromyces trifolii (Hedw. f.) Lév. was reported on white clover from Connecticut, Minnesota, Iowa, Missouri, and Manitoba, and on alsike clover from Connecticut, Minnesota and Manitoba.

Uromyces elegans (Berk. & Curt.) Lagh. (Pucciniola elegans (Berk. & Curt.) Arth) was reported on Trifolium carolinianum by Ludwig from South Carolina as of some economic importance owing to the value of the host for grazing purposes. A case was reported of badly affected spots in pastures with reduction in amount of foliage produced.

Root rots caused by various organisms

Root rot caused by Sclerotinia trifoliorum Eriks. This disease was reported from Ohio, Wisconsin, Idaho, and Oregon during the year. In Ohio there has been an increase of this root rot as compared with that caused by Fusarium. It is important mainly in the northwestern part of the state. In Oregon the disease was said to be the cause of considerable damage in the western and southern parts of the state.

Root rot caused by Fusarium sp. This root rot is reported from Ohio and Idaho in both of which states it was regarded as important.

A root rot the cause of which has not been determined was also reported as serious in Kentucky. Regarding this, Valleau sends the following statement:

> "During the past two years Fergus and Valleau have conducted extensive studies of the root systems of red clover, especially, but also white, sweet, alsike and crimson clovers and alfalfa, and have found on hundreds of plants examined always many small roots dead and being replaced by new ones. Tap roots of red clover and alsike become badly discolored either the first summer or the second and then plants live on crown roots entirely. This seems to be the cause of great mortality in certain fields the first summer and to be the cause of red clover acting as a biennial over the greater part of the country.
>
> "The extent of injury to the roots is directly correlated with the soil treatment. This part of the problem is being studied on the soil fields distributed in various soil areas of Kentucky. Lime materially reduces the injury the first summer. Lime and acid phosphate greatly reduce the injury. On blue grass soil in central Kentucky there is generally very slight injury the first season. On all soils and with all treatments there is a very serious injury the second year.
>
> "The disease seems always to be present on all clovers, but the extent of injury is dependent on rate of growth of the plant and this is dependent on soil fertility."

CLOVER - Root rots, Nematode disease, Miscellaneous diseases

eference

Selby, A. D., and R. C. Thomas. Impairment of clover seedlings reported. Monthly Bull. Ohio Agric. Sta. 6: 90-92. 1921. Fusarium sp. has consistently been associated with a root-rot disease of red clover in Ohio.

Nematode disease caused by Tylenchus dipsaci (Kühn) Bastian

The nematode disease of red clover was reported only from Idaho during 1922. In a recent publication from Idaho (1) infection is reported as having been secured on the following plants by growing them in infested soil: Beans, peas, fall vetch, Egyptian clover, and alsike clover. Varietal tests conducted at the Rothamstead Experiment Station by Goodey (2) gave the following results with regard to susceptibility:

Group 1, very susceptible:
Red clover - Canadian, French and English.
Cow-grass - Swedish.
Kidney vetch.
Group 2, much less susceptible:
Cow-grass - English.
Alsike clover - Canadian and English.
Group 3, very slightly susceptible:
Sainfoin.
White clover - Wild Cotswold, English, and Wild Kentish.
Group 4, apparently immune:
White clover - Sutton's Mammoth.
Lucerne - Provence.
Trefoil.

Literature cited:

(1) Smith, R. M. The eelworm disease of red clover. Idaho Agr. Exp. Sta. Bul. 130: 1-14. Mar. 1922.
(2) Goodey, T. On the susceptibility of clover and some other legumes to stem-diseases caused by the eelworm, Tylenchus dipsaci, syn. devastatrix, Kühn. Jour. Agr. Sci. 12: 20-30. Feb. 24, 1922.

Miscellaneous diseases

Anthracnose caused by Colletotrichum trifolii Bain - reported only from Ohio where it was serious in a few fields in the western part of the state.

Leaf spot caused by Pseudopeziza trifolii (Bernh.) Fckl. - reported from Ohio, Wisconsin and New Brunswick.

Leaf spot caused by Sphaerulina trifolii E. Rostr. - was reported on for the first time in the United States by E. F. Hopkins at the Boston meeting. He has observed it in Missouri, Illinois, and New York, principally on white clover, but red and alsike clover have also been found infected. The disease was collected in Columbia, Missouri as early as 1902. It was first observed this year in Missouri by Hopkins on March 18. (Hopkins, E. F. The Sphaerulina trifolii leaf spot of clover. (Abstract). Phytopath 13: 59. Jan. 1923.)

CLOVER, SWEET CLOVER, BUR CLOVER

CLOVER

Leaf spot caused by Macrosporium sp. - abundant and widely distributed in Louisiana and occurring also in Ohio and Minnesota

Sooty spot caused by Phyllachora trifolii Pers. (Fckl.) = (Polythrincium trifolii) Kuntze - reported from Vermont, Connecticut, Ohio, Illinois, Minnesota, and Canada on both white and red clover. L. R. Tehon in Illinois writes as follows concerning this disease:

> "It is a matter of interest to me to find that in the western part of Illinois, particularly in Madison, St. Clair, Jersey, Menard, Tazewell, and Calhoun Counties, the white clover used largely for pasture purposes is covered to a large extent with the mold Polythrincium trifolii. Practically all pastures where this clover is grown are infested. The infection of plants varies from 30 to 70% and from 60 to 70% of the leaves on these plants are affected with reduction of photosynthetic surface of from 2 to 30%."

Spot caused by Cercospora sp. - reported from Delaware (affecting stems) and from Missouri (causing slight damage to the leaves).

Mosaic - reported on red clover, particularly from Connecticut, Arkansas, Indiana, Wisconsin, and Minnesota, and, according to the Canadian Plant Disease Survey, from Quebec and Manitoba. References: (Dickson, B. T. and E. G. Hood. Temperature studies in mosaic diseases. (Abstract). Phytopath. 13: 42. Jan. 1923. Nelson, Ray. The occurrence of protozoa in plants affected with mosaic and related diseases. (Abstract). Phytopath. 13: 41. Jan. 1923).

Dodder (Cuscuta sp) - reported from Louisiana, (one field very bad).

SWEET CLOVER (Melilotus spp.)

Leaf spot and stem rot caused by Ascochyta caulicola Laub. - reported as abundant and causing considerable defoliation on the Experiment Station plots and at one place in Boone County, Missouri (Hopkins, Maneval); found in a few fields near Fargo, North Dakota, where it appears rather late, and seems to cause a blasting of the seed in seed fields. (Weniger).

Anthracnose caused by Colletotrichum trifolii Bain - Kendall County, Illinois. (Tehon).

Anthracnose caused by Gloeosporium caulivorum Kirch - Kankakee County, Illinois. (Tehon).

Root rot caused by Fusarium sp. - one severely (10-20%) affected field found in Williams County, North Dakota; cool, damp weather favorable. (Weniger).

Mosaic - observed on practically every plant in the vicinity of University Farm, Minnesota (Sect. Plant Path.).

Wilt (undet.) - East Baton Rouge Parish, Louisiana; common, some loss (Edgerton).

Root knot caused by Heterodera radicicola (Greef) Müll. - northwestern South Carolina (Ludwig).

BUR CLOVER (Medicago hispida gaertn.)

Leaf spot caused by Macrosporium sp. - abundant on bur clover in East Baton Rouge Parish, Louisiana; affecting nearly all of the crop but not causing much loss (Edgerton).

COWPEA

Leaf spot caused by Cercospora cruenta Sacc. - Delaware, Texas (four counties, prevalent, 1% loss - Taubenhaus), Illinois (first report for Illinois, collected once only, at Makanda, Jackson County, August 19; slight -(Anderson and Tehon).

Leaf spot caused by Amerosporium occonomicum E. & T. - general but not important in Delaware (Adams).

Alternaria atrans Gibson following sunburn and aphid injury on Blackeye cowpea, Arizona; (see soybean).

Powdery mildew caused by Erysiphe polygoni DC. - unimportant in Delaware and South Carolina; severe, causing defoliation in greenhouse at LaFayette, Indiana. (Gardner).

Rust caused by Uromyces appendiculatus (Pers.) Lév. - Texas.

Bacterial spot caused by Bacterium vignae Gardner & Kendrick is said to be widespread in Indiana, where it has been observed since 1919. The disease is rather destructive, but it was less important in 1922 than usual. The organism causes leaf and pod spotting, malformation of the pods, and blight of seedlings grown from infected seed. According to the authors, the organism is seed borne, and probably the use of seed from disease-free pods will control it. (Gardner, Max W., and James B. Kendrick. Bacterial spot of cowpea. Science n. s. 57: 275. March 2, 1923).

Mosaic - fairly important in Arkansas (Elliott); unimportant and rare in Indiana.(Gardner).

Wilt caused by Fusarium vasinfectum Atk.- northern South Carolina (important; importance not to be judged by number of complaints, as disease makes it necessary to raise only resistant varieties of both cotton and cowpeas - Ludwig), Arkansas.

Root rot caused by Ozonium omnivorum Shear - prevalent in Texas. (Taubenhaus).

SOYBEAN

Bacterial leaf spots: Bacterial pustule caused by Bacterium phaseoli var. sojense Hedges - was abundant in East Baton Rouge Parish, Louisiana, where it was first observed on June 21, affecting practically all of the crop, and causing a loss estimated at 3 to 5%. (Edgerton). According to Miss Hedges (5), this organism was first isolated in 1917 from Texas material. and has been found to occur from Washington southward. Bacterial blight caused by Bacterium glycineum Coerper,- reported from Steuben and White Counties, Indiana. Undetermined bacterial leaf spots have been reported from Delaware (leaf infection prevalent in all fields; not determined, probably bacterial; has been considered as due to B. lathyri but not confirmed by culture work - Adams) and Virginia (general and causing severe damage - Fromme).

Bacterial wilts: Bacterium solanacearum EFS has been found on soybean in North Carolina, according to F. A. Wolf (7). Diseased specimens were received from Columbus in August, 1921. While wilting is not a prominent symptom in the case of this host, probably because of the woody nature of the stems and petioles, the affected plants are dwarfed and the foliage is prematurely killed. The organism causing the new bacterial wilt of the bean, Bacterium flaccumfaciens, described by Miss Hedges, was successfully inoculated into the Ito San variety of soy bean (4).

Downy mildew caused by Peronospora sp. is reported by F. R. Perry from Genesee County, New York. This is the first report of a downy mildew on soybean received by the Survey, and apparently it is the first report for the United

States. According to E. J. Butler (1) Peronospora trifoliorum de Bary occurs on soybean in the province of Kashmir in India, and has been reported on this host from Formosa also; and P. trifoliorum var. manshurica Naoumoff has been described on soybean from Russian Manchuria.

Pod and stem blight caused by Phomopsis sojae Lehman has been described from North Carolina (6). It had been reported as due to Phoma sp. in 1920 by Wolf and Lehman (8). According to Lehman the causal fungus attacks pods, stems, and sometimes leaves. The pods are penetrated and the seeds invaded by the organism. The fungus overwinters in diseased stems and seed. The disease is said to be capable, especially in wet seasons, of causing serious damage to this host, and the use of disease-free seed, crop rotation, and the plowing under of diseased plants after harvest are recommended for its control.

Wilt caused by Fusarium sp. - Botetourt County, Virginia; Hampton County, South Carolina, and Lewiston, Missouri.

Wilt caused by Sclerotium rolfsii Sacc. - occasional, causing a loss of less than 1% in East Baton Rouge Parish, Louisiana.(Edgerton).

Mosaic was reported from Indiana again, and for the first time from Connecticut, New York, Virginia, Kentucky, and Louisiana. Indiana, Pennsylvania and North Carolina were the only states from which soybean mosaic had previously been reported to the Survey. There may be some question as to whether some of the mosaic reported may not really be a trouble similar to that occurring in Delaware, which Adams says is due to unbalanced nutrition (see necrosis). The Indiana disease has been proved by transmission experiments, however, to be a true mosaic (2). The following notes concerning the relative susceptibility of varieties to mosaic are interesting:

New York (Riverhead, L. I.): Soy bean mosaic was observed in a variety test plot and data as follows were taken: 100% of the plants of the varieties Black Eyebrow, Manchu, Mandarin, Wilson, and Virginia were diseased; while only 20% of those of the Peking variaty were affected. (E. E. Clayton, July 24).

Kentucky: Noticed for first time at Experiment Station. Mammoth Yellow appeared very susceptible. (Valleau).

Indiana: Worst in Hollybrook variety, severe in Haberlandt, and occurs in a number of other varieties tested. Reduces yield severely. (Gardner).

Necrosis, due to unbalanced nutrition, which is reported from Delaware as general and very important in some sections is described by Adams as follows:

> "A chlorosis on soybean leaves has been observed the past two seasons resembling mosaic symptoms. Along with the mottled appearance of the leaves an atrophy of the terminal growth occurs. About the time of maturing a conspicuous 'firing' of the leaves occurs, and in some instances a pronounded prematuring. The lower leaves on such plants showed no symptoms of chlorosis. The disturbance was found to be entirely associated with the food requirements, particularly where potash was deficient."

Alternaria atrans Gibson (3), following sunburn and aphid injury and causing a leaf-spot with resultant loss of foliage, is said to be of considerable importance in southern Arizona. The variety Virginia is affected badly enough every year to lessen seriously its value for any purpose in that region, while Biloxi was the most resistant variety found. None of the varieties studied, in-

cluding besides the two already mentioned, Otootan, Barchet, Shanghai, Tokio, and Peking soybeans, and Blackeye cowpeas, were immune to the disease.

Literature cited:

(1) Butler, E. J. Soybean: downy mildew. In Fungi and disease in plants, pp. 266-267. Thacker, Spink and Co., Calcutta and Simla. 1918.
References given under soybean downy mildew:
Sydow & Butler: Fungi Indiae Orientalis, IV; Ann. Myc., X.
Naoumoff: Fungi Ussuriensis; Bul. Soc. Myc. Fr., XXX.
Parasitic fungi of Formosa; Bot. Mag., Tokyo, XXVIII, p. (423).

(2) Gardner, Max W., and James B. Kendrick. Soybean mosaic. Jour. Agr. Res. 22: 111-113. Oct. 8, 1921.

(3) Gibson, Frederick. Sunburn and aphid injury of soybeans and cowpeas. Arizona Agr. Exp. Sta. Tech. Bul. 2: 41-46. Sept. 1922.

(4) Hedges, Florence. A bacterial wilt of the bean caused by Bacterium flaccumfaciens nov. sp. Science n. s. 55: 433-434. Apr. 21, 1922.

(5) _____ Bacterial pustule of soybean. Science n. s. 56: 111-112. July 28, 1922.

(6) Lehman, S. G. Pod and stem blight of the soybean. Jour. Elisha Mitchell Sci. Soc. 38: 13. Sept. 1922.
(Abstract of paper read before 21st ann. meet. North Carolina Acad. Sci. May, 1922).

(7) Wolf, F. A. Additional hosts for Bacterium solanacearum. Phytopath. 12: 98-99. Feb. 1922.

(8) _____, and S. G. Lehman. Notes on new or little known plant diseases in North Carolina in 1920. In North Carolina Agr. Exp. Sta. Ann. Rept. 43: 58. 1920.

VETCH (Vicia sp.)

Protocoronospora nigricans Atk. & Edg. - very common but causing slight loss in East Baton Rouge Parish, Louisiana. (Edgerton).

VELVET BEAN (Stizolobium spp.)

Bacterial leaf spot caused by Bacterium sp. - common in Louisiana.

Leaf spot caused by Cercospora stizolobii Syd. was found at Barnwell, South Carolina, in September. According to Anna E. Jenkins (1), of the Office of Pathological Collections, there are specimens of this disease in the Pathological Herbarium from North Carolina (1921), Florida (1901 and 1921), and the Philippine Islands (type locality); and specimens collected in Porto Rico by J. A. Stevenson in 1914 and 1916 on Stizolobium sp., and by F. L. Stevens on S. pruriens are considered to be of the same species. In the Survey files there is a report from G. L. Peltier of Cercospora sp. on velvet bean occurring in 1917 for the first time in Alabama.

Stem rot (cause unknown) - Barnwell County, South Carolina; unimportant.

Root knot caused by Heterodera radicicola (Greef) Müll. - According to the results of experiments conducted at the Florida Experiment Station (2) growing bunch velvet beans for one season, during which they are kept cleanly cultivated, greatly reduces the number of nematodes and makes it possible to grow snap beans the following season.

Literature cited:

(1) U. S. Dept. Agr. Office Path. Col. Pathological Herbarium Notes 4: 11. April 1, 1922.

(2) Watson, J. R. Bunch velvet beans to control root-knot. Florida Agr. Exp. Sta. Bul. 163: 55-59. June 1922.

HORSE BEAN (Vicia faba)

Chocolate spot or streak disease caused by Bacillus lathyri Manns & Taubenhaus has been reported from England and Wales (1). It is said not to be especially important except under exceptional conditions of hot, moist weather.

Literature cited:

(1) Paine, S. G. and M. S. Lacey. Chocolate spot or streak disease of broad beans. Jour. Min. Agr. Great Britain 29: 175-177. May 1922.

B. SUNFLOWER

Rust caused by Puccinia helianthi Schw. was reported from Connecticut, Delaware, Wisconsin (may be some loss when grown for silage by loss of lower leaves; of minor importance as a rule), Minnesota, Colorado, California (common in the interior valley on wild sunflowers; found at Manteca, San Joaquin County, on cultivated sunflowers causing only slight injury), and by the Dominion Plant Disease Survey from Quebec, Ontario, Manitoba, and Saskatchewan (1).

Wilt caused by Sclerotinia sp. was not reported to the Survey in 1922. In Canada, however, according to the Dominion Plant Disease Survey report (1), it occurred in Quebec, Ontario, Manitoba, and British Columbia, but was not of general importance except in Quebec.

Powdery mildew caused by Erysiphe cichoracearum DC. - Connecticut, Washington, Manitoba (1).

Downy mildew caused by Plasmopara halstedii (Farl.) Berl. & de Toni - Tipton County, Indiana.

Leaf spot caused by Septoria helianthi E. & K. - Connecticut, Minnesota.

Dodder (Cuscuta sp.) - Whitman County, Washington.

Literature cited:

(1) Drayton, F. L., compiler. Survey of the prevalence of plant diseases in the Dominion of Canada, 1922. Third Ann. Rept. (mimeographed). Division of Botany, Experimental Farms Branch, Dept. Agr. 1922.

C. GRASSES

TIMOTHY

Rust caused by Puccinia phlei-pratensis Eriks. & Henn. was reported from New York, West Virginia, Minnesota, Iowa, North Dakota, and Oregon.

Leaf spot caused by Scolecotrichum graminis Fckl. - Anoka County, Minnesota, June 22.

Smut caused by Ustilago striaeformis (Westd.) Niessl was reported from New York (in private lawn at Ithaca, June), Iowa, North Dakota, and Skagit County, Washington.

Recent literature:

Davis, W. H. Germination of the spores of timothy smut (Ustilago striaeformis (Westd.) Niessl.). (Abstract). Phytopath. 13: 38-39. Jan. 1923.

Leaf spot caused by Heterosporium phlei Gregory - Laurel, New York, July 6.

Zonate eye-spot caused by Helminthosporium giganteum H. & W. - see under miscellaneous grasses.

Take-all caused by Ophiobolus cariceti (Berk. & Br.) Sacc. - Cayuga and Tompkins Counties, New York; found only in badly diseased (take-all) wheat fields. (Kirby & Barrus).

Proliferation of spike (physiological) - North Branford, Connecticut, October 26. Glumes turned into leaves. (Clinton).

SUDAN GRASS (Holcus sorghum sudanensis (Piper) Hitchc.)

Bacterial blight caused by Bacillus sorghi Burr. - found in serious form at Yuma, Arizona.(D. C. George).

Anthracnose caused by Colletotrichum cereale Manns - North Dakota.

MISCELLANEOUS GRASSES

Brown patch caused by Rhizoctonia solani Kühn

Clinton reports that in Connecticut this disease gave much trouble in lawns early in the season, which was wet. However, it was not always possible to find a fungus as the cause of the trouble. He thinks that winter injury and sun-scorch are probably contributing causes. Fescue, red top, and bent were the grasses most injured by the disease in Connecticut, while blue grass was not much damaged.

The use of Bordeaux, either dry or liquid, has been reported to give good results in the control of this disease (1). The grass should be kept covered with the spray until late in the season; during the most dangerous periods (moist hot weather) the Bordeaux should be applied every two or three days, and in no case should there be longer than a week between applications. After every rain or watering a new application should be made.

Literature cited:

(1) Carrier, Lyman. Brown-patch and the Bordeaux treatment. Bul. Green Sect. U. S. Golf Assoc. 2: 109-116. April 1922.

Claviceps purpurea (Fr.) Tul.

Agropyron repens (L.) Beauv. - New York, Saskatchwean (2)
Agropyron smithii Rydb. - Saskatchewan (2)
Calamagrostis americana Scrib. - Saskatchewan (2)
Elymus macounii Vasey - Saskatchewan (2)
Spartina pectinata Bosc. - Saskatchewan (2)

Erysiphe graminis DC.

Agropyron repens (L.) Beauv. - New York, Minnesota
Agropyron tenerum Vasey - Minnesota
Agrostis palustris Huds. (A. alba) - Minnesota
Dactylis glomerata L. - Minnesota
Elymus canadensis L. - Minnesota
Poa pratensis L. - Minnesota, Missouri

Helminthosporium bromi Died.

Bromus inermis Leyss. - Minnesota, North Dakota (severe early in season).

Helminthosporium giganteum H. & W. (4)

near Washington, D. C., on:
Agropyron elongatum Host - severe
Agropyron intermedium Beauv. - severe.
Agropyron repens (L.) Beauv. - severe
Agrostis stolonifera L. - moderate
Bromus inermis Leyss. - severe
Capriola dactylon (L.) Kuntze = (Cynodon dactylon L.) - very severe.
Eleusine indica (L.) Gaertn. - severe
Elymus virginicus L. - moderate
Eragrostis cilianensis (All.) Link = (E. major Host) - slight
Eragrostis pectinacea (Michx.) Nees - slight
Homalocenchrus virginicus (Willd.) Britton = (Leersia virginica Willd.) - moderate
Lasiagrostis splendens Kunth - severe
Muhlenbergia mexicana (L.) Trin. - slight
Muhlenbergia schreberi Gmel. - slight
Panicum anceps Michx. - slight
Panicum clandestinum L. - slight
Panicum dichotomiflorum Michx. - slight
Panicum gattingeri Nash - slight
Pennisetum japonicum Trin. - slight
Phalaris arundinacea L. - very severe
Phleum pratense L. - slight
Poa pratensis L. - slight

MISCELLANEOUS GRASSES

Helminthosporium ravenelii M. A. Curtis

Sporobolus berteroanus (Trin.) Hitch. & Chase - Florida (very severe)

Helminthosporium sp.

Poa pratensis L. - Connecticut (Same disease as the one reported by Drechsler (3) as having been found in Wisconsin, Illinois, New York, Connecticut, Massachusetts, Maine, Maryland, Virginia).

Ophiobolus cariceti (Berk. & Br.) Sacc.

Reported by Kirby from New York on:
Agropyron repens (L.) Beauv. - very important as a harborer of this disease.
Agrostis palustris Huds. (A. alba) - only in take-all infested wheat fields.
Bromus secalinus L. - only in take-all infested spots in wheat fields.
Poa compressa L. - new on this host; important as a take-all host.

Phyllachora graminis (Pers.) Fckl.

Agropyron repens (L.) Beauv. - Minnesota
Elymus canadensis L. - New York, Minnesota
Hystrix patula Moench - Minnesota
Muhlenbergia sp. - Minnesota

Physarum cinereum (Batsch) Pers.

Lawn grasses - Connecticut (injury slight, mechanical)

Piricularia grisea (Cke.) Sacc.

Syntherisma sanguinalis (L.) Dulac (Digitaria sanguinalis Scop.) - Illinois.

Puccinia clematidis (DC.) Lagerh.

Reported from Manitoba by V. W. Jackson (2) on:
Agropyron tenerum Vasey
Agropyron spp.
Bromus spp.
Elymus spp.

Puccinia coronata Cda.

Avena sp. (wild oats) - Minnesota
Festuca elatior L. - New York

Puccinia cynodontis Lacroix

Capriola dactylon (L.) Kuntze - Florida

Puccinia glumarum (Schm.) Erikss. & Henn.

(* - New hosts determined by artificial inoculation, reported by Hungerford, Idaho)

*Agropyron acutum C. Koch
*Agropyron longifolium
*Agropyron tenerum longifolium
*Bromus adoënsis Hochst.
*Bromus erectus Huds.
*Bromus lanuginosus Poir.
*Bromus macrostachys Desf.
*Bromus maximus Desf.
*Bromus porteri frondosus
*Bromus purgans latiglumis Shear
*Bromus richardsonii Link.
*Bromus rigidus Roth.
*Hordeum bulbosum L.
Hordeum jubatum L. - Alberta (G. E. Delong (2), Idaho
*Hordeum maritimum With.
Hordeum nodosum L. Idaho
*Phalaris canariensis L.
Wild grasses - California

Puccinia graminis Pers.

Agropyron caninum (L.) Beauv. - Minnesota
Agropyron repens (L.) Beauv. - New York, Minnesota
Agropyron smithii Rydb. - Minnesota
Agropyron tenerum Vasey - Minnesota
Agrostis palustris Huds. - New York (near infected barberry), West Virginia, Minnesota
Alopecurus geniculatus L. - Minnesota
Bromus sp. - Minnesota
Dactylis glomerata L. - New York, Minnesota
Elymus canadensis L. - Minnesota
Elymus virginicus L. - Minnesota
Hordeum jubatum L. - Illinois (near barberry), Minnesota (particularly heavy near barberry), Montana (near barberry), Alberta (2)
Lolium temulentum L. - Minnesota
Grasses (species not given) - Manitoba (V. W. Jackson (2)), and Saskatchewan (P. M. Simmonds (2))

Puccinia poarum Niels.

Poa pratensis L. - South Carolina, Minnesota

Puccinia subnitens Diet.

Distichlis spicata (L.) Greene)salt-grass) - Washington (telial host for rust on spinach)

Pythium sp.

Agrostis palustris Huds. - Whitneyville, Connecticut, October 9. On young grass and new lawn but did not seem to injure roots much. Cultures obtained. (Clinton).

Sclerospora graminicola (Sacc.) Schr.

Chaetochloa italica (L.) Scribn. (Setaria italica Beauv.) - Minnesota
Chaetochloa viridis (L.) Scribn. (Setaria viridis (L.) Beauv.) - Minnesota, Iowa

Scolecotrichum graminis Fckl.

Alopecurus pratensis L. (meadow foxtail) - Indiana

Septoria sp.

Bromus inermis Leyss. (brome grass) - North Dakota
(See also Weber's article in Phytopathology (7)).

Sorosporium syntherismae (Peck) Farl.

Millet - Saskatchewan (2)

Urocystis agropyri (Preuss) Schröt.

Agropyron repens (L.) Beauv. - New York
Agrostis palustris Huds. - Wisconsin (1921, first report on this host (1))
Melica imperfecta Trin. - California (6)

Uromyces dactylidis Otth

Dactylis glomerata L. - Virginia, found at Blacksburg in October; prevalent here, distribution in other parts of state. First collection in Virginia and second in United States. (Fromme)

Ustilago neglecta Niessl

Chaetochloa lutescens (Weigel) Stuntz (Setaria glauca) - Minnesota

Ustilago panici-miliacei (Pers.) Wint.

Panicum miliaceum L. - North Dakota, Washington (5)

Ustilago striaeformis (Westend.) Niessl

Poa pratensis L. - New York

Smut (cause not given)

Bromus spp. - Colorado

MISCELLANEOUS GRASSES

Wojnowicia graminis (McAlp.) Sacc. & D. Sacc.

Agropyron smithii Rydb. - Kansas

Winter injury

Festuca spp. - Connecticut, some of the trouble of lawns consisting of this grass seems to be partly due to winter injury (Clinton)

Recent litarature:

(Cited):

(1) Davis, W. H. Urocystis agropyri on redtop. Mycologia 14: 279-281. Sept. 1922

(2) Drayton, F. L., compiler. Survey of the prevalence of plant diseases in the Dominion of Canada, 1922. Third Ann. Rept. (mimeographed). Division of Botany, Experimental Farms Branch, Dept. Agr. 1922

(3) Drechsler, Charles. A new leaf spot of Kentucky Blue Grass caused by an undescribed species of Helminthosporium. (Abstract). Phytopath. 12: 35. Jan. 1922.

(4) _____ The occurrence of zonate eye-spot on various grasses and its mode of extension. (Abstract). Phytopath. 13: 59-60. Jan. 1923.

(5) Heald, F. D. Report of the Division of Plant Pathology. Washington Agr. Exp. Sta. Bul. 167: 38-43. 1922.

(6) U. S. Dept. Agr. Office Path. Coll. Pathological Herbarium Notes 5. Nov. 1, 1922.

(7) Weber, George F. Septoria diseases of cereals. III. Septoria diseases of rye, barley, and certain grasses. Phytopath. 13: 1-23. Jan. 1923.

Septoria agropyri Ell. & Ev. on Agropyron repens; S. bromi Sacc. on Bromus altissimus, B. inermis, (found in 1920, first time reported on this species in this country), B. secalinus; Septoria sp.(not S. graminum Desm.) on Poa pratensis; all in Wisconsin.

(Not cited):

Bubak, Franz. Une nouvelle espece du genre Urocystis. Bol. R. Soc. Espan. Hist. Nat. 22: 205-207. Apr. 1922. Urocystis bolivari on Lolium perenne.

Kulkarni, Gopal Subrao. Smut (Ustilago paradoxa Syd. and Butl.) on sawn (Panicum frumentaceum Roxb.) Jour. Indian Bot. 3: 10-11. May 1922.

Mains, E. B. Observations concerning Puccinia pattersoniana and Puccinia moreniana. Proc. Indiana Acad. 1921: 133-135. 1922.

P. pattersoniana occurs on several grasses (Agropyron spicatum, Elymus condensatus, E. triticoides, Sitamion jubatum) in Montana, Oregon, Washington, Utah, California, and New Mexico. It is believed that the aecial stage may occur on some species of Brodiaea, since the teliospores of P. moreniana, a short cycled rust on Brodiaea capitata, have distinguishing characteristics strikingly similar to those of

P. pattersoniana, and it has previously been found that a number of short cycled rusts possess teliospores very similar to those of heteroecious long cycled species with aecia on the host of the short cycled species; also aecia on B. douglasii have been found associated with P. pattersoniana in Utah.

Maneval, W. E. Germination of teliospores of rusts at Columbia, Missouri. Phytopath. 12: 471-488. Oct. 1922.

Among other rusts studied were the following on grass hosts: Puccinia andropogonis Schw. on Andropogon furcatus Muhl., Puccinia peridermiospora (Ell. & Tracy) Arth. on Spartina michauxiana Hitchc., Puccinia sydowiana Diet. on Sporobolus asper (Michx.) Kunth, Puccinia windsoriae Schw. on Tridens flavus (L.) Hitchc.

DISEASES OF FRUIT AND NUT CROPS IN THE UNITED STATES IN 1922

Prepared by J. F. Adams

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CONTENTS

Introductory statement 268
The weather of 1922 269
Fruit diseases of 1922 273
Diseases of pome fruits 273
Apple 273
Scab 275
Blotch 283
Bitter rot 288
Blister canker 290
Black rot 291
Cedar rust 294
Fire blight 299
Collar rot 304
Fruit spot (Phoma) 304
Anthracnose 305
European canker 306
Powdery mildew 306
Crown gall 308
Sooty blotch and fly speck. 309
Root rots 310
Bitter pit 311
Water core 312
Blue mold rot 313
Miscellaneous 313
Fruit rots and leaf spots 313
Bark cankers 314
Non-parasitic diseases .. 315
Winter injury 316
Spray injury 316
Dusting vs. spraying 318
Orchard disease surveys ... 318
General references 321
Pear 322
Quince 329
Diseases of stone fruits 330
Peach 330
Brown rot 330
Leaf curl 335
Scab 338
Bacterial spot 340
Rust 342
Blight (Coryneum) 342
Black mold rot 342
Yellows 343
Rosette 343
Little peach 343
Root knot 343
Miscellaneous 344
Parasitic 344
Non-parasitic 344
Frost injury 345
Spray injury 345
General references 346
Plum and prune 346
Cherry 351
Apricot 355
Diseases of small fruits 357
Grape 357
Strawberry 362
Raspberry 367
Blackberry 372
Currant 373
Gooseberry 374
Cranberry 374
Mulberry 375
Diseases of sub-tropical fruits 376
Citrus 376
Fig 384
Date 386
Avocado 386
Olive 387
Mango 387
Persimmon 387
Guava 387
Loquat 388
Banana 388
Pomegranate 388
Anerrhoa 388
Diseases of nuts 389
Pecan 389
Walnut 391
Almond 391
Coconut 392

INTRODUCTORY STATEMENT

The fruit disease situation in the United States in 1922 was in marked contrast to that in the preceding year. Notwithstanding the spring freezes, conditions were more generally favorable for a normal crop in 1922. It was commonly predicted that the general neglect of control practices in the sections affected by frosts in 1921 would result in an increase in the prevalence of orchard diseases in the following year, due to the more abundant supply of overwintering inoculum and the consequent increased possibility of infection and greater difficulty of control. This prediction of greater importance of diseases proved to be quite true in the eastern apple belt, but the favorable weather conditions in the spring of 1922 must be considered as an important contributing factor.

The economic loss due to unmarketable fruit resulting from disease was much greater than in 1921, due both to increased yield and increased amount of disease. The production of apples, pears, and peaches showed the following respective increases over 1921: 35.5%, 38%, and 30.9%. Nowadays a complete loss seldom results from unmarketable fruit, as was formerly the case. A larger number of "cull apples" are being utilized at present for by-products such as jelly, apple butter, cider, vinegar, etc., and even the pomace from the cider mills is being used in the production of pectin.

In summarizing the data submitted by collaborators in 1922, certain conditions have been stated and suggestions made which are pertinent to disease problems of general concern. Greater cooperation along certain lines indicated in the summary would assist materially in explaining and correlating disease conditions and contribute to the working-out of more effective control measures. The Plant Disease Survey affords a "clearing-house" for brief reports on the results of investigations that might be seriously delayed through other means of publication.

Information on the first seasonal appearance of a disease would be more valuable if definite data were included on the stage of growth of the host. Phenological data should prove of great assistance in correlating facts regarding disease prevalence. The association of a certain stage of development of the host, such as the pink or petal-fall stage of apples, for instance, with the dates of first appearance of a disease, would prove of great assistance in determining the reasons for regional occurrence and varietal susceptibility.

Greater cooperation is needed in the control of certain diseases in order to prevent their increased distribution through nursery stock. This situation is particularly true of crown gall and apple blotch. More intensive investigations as well as greater publicity through the extension specialist are timely necessities for the future economic control of these diseases.

A number of special reports on orchard disease surveys have been included in this summary. The detailed data given in these reports present most strikingly the situation with regard to diseases in large commercial orchard communities and indicate the importance of the control problems.

Several collaborators, also, have submitted extensive observations on relative varietal susceptibility to certain diseases. Where large varietal tests of fruits are being conducted it is possible to secure data on susceptibility or resistance which are of especial importance, and it is urged that collaborators send more reports of this nature where opportunity presents.

Considerable interest is manifested in the use of the home-made and commercial calcium caseinate spreader in connection with the orchard sprays. Reports of the results of experiments on the use of spreaders in increasing the distribution and fungicidal efficiency of sprays should prove of interest for next year's summary.

WEATHER OF 1922.

Rainfall by Months

(Abstracted from Monthly Weather Review, Volume 50, 1922.)

January. The total precipitation for the month was generous over the Gulf and Atlantic Coast states and in the Ohio and lower Mississippi Valleys. The precipitation was usually light over the northern districts east of the Rocky Mountains and over the Pacific Coast and northern Plateau states there was a well marked deficiency.

February. The rainfall of the month was generous and usually above normal over the Gulf and South Atlantic states, the total amounts ranging from 4-8 inches over a wide area from eastern Texas to southern Virginia. Precipitation was generally above normal in California, the middle Plateau, northern Plains, and Great Lakes region.

March. In the Central Valleys and eastern districts, March was generally rainy, the total falls for the month being in excess of the normal over all states from the Great Plains eastward to the Atlantic Coast, save in Maine, Florida, and the Dakotas.

April. In general the month had decidedly more rainfall than is normally received in April over a large part of the Central Valleys and portions of the near Southwest. It was less than normal in most Atlantic Coast sections, along the east Gulf Coast, over the Florida peninsula, and generally over California, Oregon, and portions of adjoining states.

May. Rain was generally abundant, and in many sections far above normal, from Texas and Oklahoma eastward. In Ohio and middle Mississippi Valleys, Iowa, and Missouri, the monthly amounts were usually slightly less than normal.

June. Precipitation was frequent and usually heavy over most eastern districts. In fact portions of New York and New England had more rain than ever previously recorded in June. In portions of Illinois, Indiana, Iowa, and locally in adjoining states, the total fall for the month was less than one inch.

July. Rainfall was frequent, and in many instances heavy over most districts from the Rocky Mountains eastward during the first two decades of the month, and there were local heavy falls during the last decade in portions of the South Atlantic states and the lower Missouri Valley.

August. Precipitation was well distributed during the month, though the amounts were mainly less than normal, over the Atlantic Coast districts, particularly from North Carolina to Florida, and rain was frequent in Colorado and adjoining portions of the Mountain and Plateau regions.

September. There was a general lack of rainfall over all parts of the country. Of the 48 states only 4 had average precipitation equal to or above the normal; namely, Florida, Ohio, Michigan, and North Dakota.

October. Precipitation was deficient over the greater part of the country. Only a few of the states along the south Atlantic and east Gulf Coasts and those bordering the Pacific had state-wide averages appreciably above the normal.

November. While precipitation was markedly deficient over the more eastern sections, those immediately west of the Mississippi River and extending thence to the Rocky Mountains had, in the main, abundant moisture.

December. From the middle and lower Mississippi Valley eastward the month's precipitation was generally well above normal, but from Maryland northeastward and in the Lake region the amounts were mainly less than normal, though

not seriously deficient save in a few areas. From the upper Mississippi Valley and South Dakota southwestward to the Rio Grande and the southern borders of Arizona and California there was a marked deficiency. Over most of California, Nevada, and Utah, and the states to northward, and usually in Montana and North Dakota the monthly totals were close to or above normal, and considerable excesses were the rule in the central and northern portions of Utah and Nevada, in western and north-central Oregon, and in central California, also near the south-central coast of that state.

Temperature by Months

(Abstracted from Monthly Weather Review, Volume 50, 1922.)

January. For the month as a whole, temperatures were below normal in all districts west of the Rocky Mountains. Monthly averages were also below normal by small amounts from Texas northeastward to the Ohio Valley and over much of the Atlantic Coast area.

February. The month as a whole was marked by continuous but not severe cold over the upper Missouri Valley, and it was colder than normal over all districts from the Rocky Mountains westward.

March. For the month as a whole, the temperature averaged below normal over all districts from the Rocky Mountains westward and in portions of the West Gulf states. Over the districts to the eastward, the temperature averages were mainly above normal.

April. As a whole, the month continued warmer than normal over most districts from the Great Plains eastward. It continued colder than normal over the more western districts. Cold periods occurred about the 22nd to 24th in portions of the Ohio Valley and Middle Atlantic states.

May. From the Rocky Mountains eastward the month, as a whole, was warmer than normal, and distinctly so over the central and northern districts. The month was among the warmest of record.

June. No unusual heat or cold occurred during the month over extensive areas or periods, and the ranges from day to day were usually small.

July. The average temperatures were below normal throughout the Great Central Valleys, most eastern districts, and over the middle Gulf states. They were well above normal over Texas and the far Southwest, the central valleys of California, and the central and eastern portions of Washington and Oregon.

August. The month as a whole, was distinctly warm over the Great Central Valleys, and mainly cool over eastern districts, but with marked variations from normal conditions save in a few instances at any period.

September. The mean temperature of the month, as a whole, was above normal in practically all parts of the United States. Throughout much of the country from the Rocky Mountains westward it was the warmest September in many years.

October. Average temperatures above normal over all portions of the country from the Erie region northeastward, along the immediate middle Gulf Coast, and in the Great Valley of California. Freezing weather occurred in all the states except Florida, the more northern portions of the Gulf states, and the elevated sections of the South Atlantic states.

November. The average temperature for the month, as a whole, was above normal in practically all portions of the United States and to the eastward of the Rocky Mountains, and decidedly so from Kansas and Missouri northward.

December. The month averaged colder than normal in all northern portions the deficiency being greatest, 5° to 9° per day, from central Washington east-

Table 78. Departure from the normal temperature and rainfall by states - April to September, 1922. (Figures taken from United States Department of Agriculture Monthly Weather Review 50: 1922.)

	Departure from normal											
	Temperature (°F)						Precipitation (inches)					
	April	May	June	July	August	September	April	May	June	July	August	September
Ala.	+3.7	+0.5	+0.6	0.0	-0.7	+2.5	-0.24	+2.63	-0.54	-1.06	-1.54	-2.04
Ariz.	-4.0	+1.8	+2.4	+1.6	+1.4	+2.4	+0.02	+0.05	+0.22	-0.69	+0.04	-0.06
Ark.	+2.2	+1.6	+1.8	+0.3	+1.0	+2.3	+0.72	-0.12	-1.44	+0.20	-1.93	-2.08
Calif.	-4.1	+0.7	+0.6	+0.2	-1.2	+4.5	-0.97	+0.04	-0.10	+0.07	-0.02	-0.50
Colo.	-2.2	+0.3	+2.7	+3.5	+2.8	+2.5	+0.30	-0.41	-0.57	-0.33	+0.11	-1.05
Fla.	+3.4	+0.9	+0.4	-0.4	-1.3	-0.8	-1.71	+3.16	-0.37	-0.89	+1.44	+0.73
Ga.	+3.4	0.0	+0.5	+0.2	-1.6	+1.3	0.00	+3.79	+0.45	-0.81	-2.05	-2.10
Ida.	-4.2	-0.5	+4.0	+1.1	+2.3	+3.4	+0.28	-0.49	-0.34	-0.26	+0.88	-0.71
Ill.	+2.1	+3.8	+2.4	-0.9	+1.0	+3.3	+1.64	-0.64	-2.36	+0.25	-1.62	-1.57
Ind.	+2.6	+4.3	+1.4	-1.1	+0.3	+3.9	+2.61	-0.50	-1.91	+0.04	-1.15	-1.15
Iowa	+1.2	+2.9	+3.1	-2.6	+2.0	+3.7	+0.20	-1.04	-2.56	+2.35	-0.62	-1.33
Kansas	+0.8	+1.2	+2.3	-1.1	+2.9	+3.8	+2.62	+0.04	-1.87	+1.49	-1.70	-0.78
Ky.	+3.6	+2.3	+1.7	-0.3	-0.5	+2.7	+0.30	-0.08	-1.08	+0.47	-1.13	-0.54
La.	+3.5	+1.2	+0.3	-0.4	-0.2	+0.9	-0.49	+2.45	+0.87	-0.46	+0.09	-0.76
Md.-Del.	+1.4	+1.8	+2.7	-0.4	-1.7	+1.3	-1.44	-0.48	+1.10	+1.37	-1.06	-0.53
Mich.	+0.6	+5.9	- -	-1.4	+1.0	+2.7	+1.07	-0.38	- --	+0.71	-0.74	+0.76
Minn.	+0.1	+5.9	+2.6	-1.7	+3.9	+4.3	-0.16	-0.35	-1.00	-1.40	-1.59	-0.96
Miss.	+3.7	+1.1	+0.9	-0.2	-0.3	+1.5	-0.23	+1.34	-0.59	-0.42	-1.17	-1.95
Mo.	+1.9	+2.3	+3.1	-0.7	+1.2	+2.6	+2.42	-1.77	-2.89	+1.82	-1.60	-0.57
Mont.	-3.9	-0.3	+3.6	-0.4	+3.4	+4.2	+0.78	+0.03	-0.37	+0.48	+0.24	-0.73
Nebr.	+0.2	+1.2	+2.9	-2.0	+3.7	+4.7	+0.22	-0.82	-1.35	+1.10	-1.00	-1.25
Nev.	-5.5	+0.3	+3.6	+1.1	-0.5	+3.9	-0.01	-0.29	+0.01	+0.19	+0.72	-0.44
New Eng.	+1.0	+2.3	+1.3	-0.5	+0.1	+1.4	-0.33	+0.82	+4.95	-0.29	+1.49	-1.06
N.J.	+1.5	+2.6	+2.5	-0.7	-0.9	+1.1	-1.08	+0.04	+2.52	+1.00	-0.65	-1.45

State	Departure from normal													
	Temperature (°F)						Precipitation (inches)							
	April	May	June	July	August	September	April	May	June	July	August	September		
N. M.	-0.8	+0.6	+1.2	+1.3	+2.5	+2.3	+0.05	-0.19	-0.18	-1.25	-0.38	-0.53		
N. Y.	+1.0	+3.1	+1.5	-0.5	-0.4	+1.9	+0.32	-0.36	+4.26	-0.63	+0.91	-1.33		
N. C.	+2.9	+0.4	+1.5	+0.5	-2.2	+1.5	+0.13	+1.04	+1.40	+1.05	-0.32	-2.23		
N. D.	+0.6	+3.7	+0.7	-1.9	+4.4	+3.4	-0.46	+0.56	+0.26	-0.21	-0.92	+0.52		
Ohio	+2.6	+3.3	+1.5	-0.9	-1.3	+2.7	+1.32	+1.11	-0.76	-0.15	-0.33	+0.14		
Okla.	+0.8	+1.4	+1.3	+0.7	+3.0	+2.6	+3.52	+0.56	-2.29	+0.97	-1.79	-1.57		
Ore.	-3.2	+0.7	+4.1	+2.3	0.0	+2.9	-0.11	-0.75	-0.65	-0.52	+0.51	-0.48		
Pa.	+1.4	+2.7	+1.9	-0.2	-1.2	+3.0	-0.50	-0.54	+0.91	-0.53	-1.03	-1.79		
S. C.	+2.1	-0.2	+0.6	+0.1	-2.4	+1.0	+2.14	+2.31	+0.58	+1.22	-0.98	-2.70		
S. D.	+0.8	+2.7	+3.0	-1.7	+4.0	+4.4	-0.69	-0.05	-0.33	+0.55	-1.14	-1.47		
Tenn.	+3.6	+1.5	+1.4	-0.1	-0.9	+2.6	+0.84	+0.57	-0.29	+0.86	-1.08	-1.32		
Texas	+1.5	+2.0	-0.7	+0.5	+1.8	+1.3	+3.04	+1.14	+0.36	-0.99	-1.43	-0.34		
Utah	-5.8	+0.2	+4.0	+0.9	+1.8	+3.6	+0.53	+0.02	-0.25	-0.17	+1.04	-0.87		
Va.	+2.5	+1.0	+1.9	-0.2	-1.6	+1.2	-1.19	+0.38	+0.73	+2.22	-0.01	-2.11		
Wash.	-2.9	-0.7	+4.6	+1.7	+1.0	+2.7	+0.09	-0.74	-1.38	-0.72	+0.72	-0.05		
W. Va.	+2.9	+1.8	+1.8	-0.1	-2.8	+1.6	-0.37	-0.22	+0.45	-0.19	-0.07	-0.60		
Wis.	+0.1	+6.1	+1.7	-2.1	+1.9	+2.8	+1.05	-0.40	+0.18	+0.22	-1.38	-0.03		
Wyo.	-3.6	+0.3	+3.2	-0.9	+4.1	+4.0	+0.51	-0.04	-0.31	+0.24	+0.55	-1.01		

ward to western North Dakota. From a line through northern Pennsylvania, southern Iowa, and the northern borders of Utah and Nevada southward, the month averaged milder than normal, and in the Gulf and southern Appalachian regions usually as much as 6° warmer than normal.

FRUIT DISEASES OF 1922

DISEASES OF POME FRUITS

APPLE

The spring freezes this year were not as destructive throughout the commercial apple region east of the Mississippi as last year. Conditions were more favorable generally for the possible maturity of a normal crop. The larger yield in apples this year is indicated by the comparative estimate of production of apples in the United States for 1922 and 1921 as shown in Table 79. The average for all the states was 68.5 in 1922 compared with 33.0 in 1921. There were ten states showing less than 50% of a possible full crop. Five of these ten states, Rhode Island, Virginia, West Virginia, Ohio, and Arizona, experienced severe frost injury according to the weather data and reports by collaborators. In Table 79 is further indicated the region of lowest production because of frost injury in 1921 and 1922 in apples as well as pears and peaches.

Scab caused by Venturia inaequalis (Cke.) Wint.

While there was less scab than usual in the Northwest, because of unfavorable weather; increased prevalence and loss characterized the disease as epiphytotic in the commercial apple growing sections of the East.(See figs. 38 and 39.) This condition would naturally be expected because of the general neglect of spraying in 1921, which allowed the overwintering of an unusual amount of infective material. Moreover, analysis of the reports of collaborators indicates that weather conditions in this region this spring favored infection in two ways: first, by inducing in many sections the earlier beginning and longer continuance of the period of ascospore discharge; and second, by preventing the timely application of spray materials so as to obtain their maximum efficiency.

Importance of apple scab in 1922

Scab was probably the cause of sending more apples to the "cull pile" in 1922 than any other one factor.

It will be seen from figure 38 that almost every state east of the Mississippi, and Missouri and Kansas, reported apple scab as more prevalent than usual. Several states reported it as the worst disease of the year on apple. In Virginia Fromme says that for apple scab 1922 was the "worst year in history," and Butler states that it was "the worst year I have seen since I have been in New Hampshire." Anderson said that in Illinois it was worse than he had ever seen it before. In Michigan the disease was said to be more severe than in any

Table 79. Comparative estimates of percentages of a full crop of apples, pears, and peaches, in 1921 and 1922. (U. S. Dept. Agr. Mo.Crop Reporter 7: 110, 137, Sept. and Nov., 1921, Weather, Crops, and Markets 2: 248,448, Sept. 16 and Nov. 18, 1922.)

State	Per cent of a full crop					
	Apples		Pears		Peaches	
	1921	1922	1921	1922	1921	1922
Maine	85	33	80	70	--	--
New Hampshire	42	45	64	97	61	65
Vermont	40	60	60	85	--	--
Massachusetts	25	70	46	84	60	80
Rhode Island	15	40	40	68	30	70
Connecticut	31	52	60	85	75	75
New York	28	78	50	93	60	95
New Jersey	24	87	23	63	13	80
Pennsylvania	12	60	25	72	14	65
Delaware	7	98	6	45	2	92
Maryland	8	60	8	57	7	55
Virginia	4	44	6	54	4	56
West Virginia	4	45	2	35	3	55
Kentucky	9	78	3	75	7	87
Tennessee	12	80	21	60	16	91
North Carolina	13	78	38	65	40	86
South Carolina	50	66	72	65	58	65
Georgia	40	76	61	74	100	59
Florida		--	40	60	72	60
Alabama	45	61	63	65	68	45
Mississippi	41	66	59	76	50	69
Louisiana	46	37	55	69	54	45
Texas	45	44	60	65	44	40
Oklahoma	24	57	14	73	10	69
Arkansas	2	40	30	67	20	68
Ohio	19	41	18	75	8	66
Indiana	15	64	19	88	5	93
Illinois	15	81	16	85	7	110
Michigan	40	75	51	96	24	90
Wisconsin	40	88	65	94	--	--
Minnesota	47	68	--	--	--	--
Iowa	16	98	10	95	15	100
Missouri	4	85	1	75	0	99
North Dakota	--	--	--	--	--	--
South Dakota	30	94	--	--	--	--
Nebraska	7	90	5	90	0	90
Kansas	4	80	2	90	1	90
Montana	81	60	81	90	--	--
Wyoming	--	90	--	--	--	--
Colorado	65	85	120	90	70	90
New Mexico	30	50	25	20	4	40
Arizona	30	45	60	70	31	85
Utah	83	90	76	88	57	85
Nevada	50	75	55	90	25	55
Idaho	91	78	81	90	60	74
Washington	103	77	80	80	59	75
Oregon	90	80	80	85	38	85
California	75	88	63	118	72	98
United States	33.0	68.5	48.2	86.3	46.5	77.4

APPLE - Scab

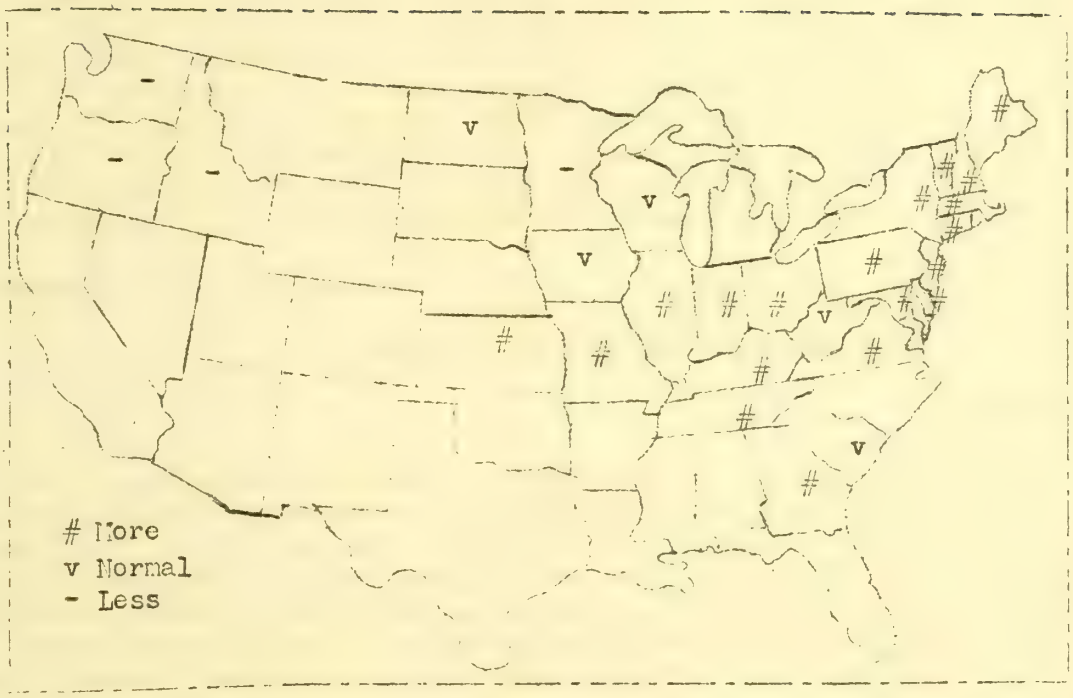

Fig. 38. Prevalence of apple scab in 1922 as compared with the average year.

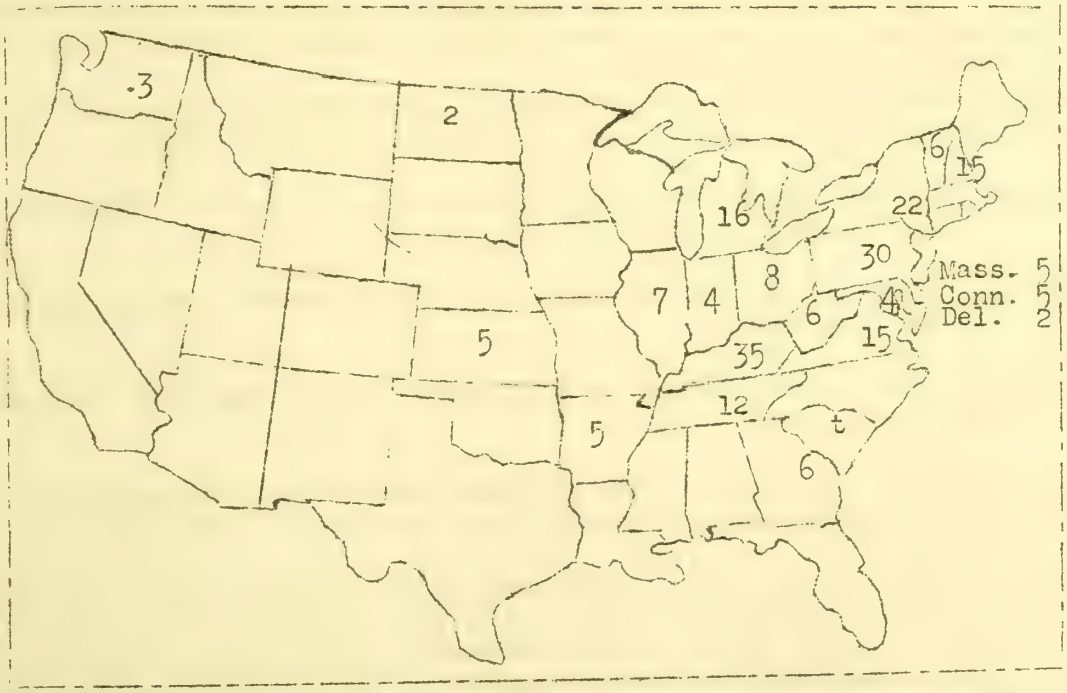

Fig. 39. Estimated percentage, loss of apples due to scab, 1922.

year since 1915. Osmun reports the outbreak in Massachusetts also as the most severe in many years. While there was not more than the usual amount in West Virginia, Arkansas, Wisconsin, and Iowa, and less than normal in Minnesota, the disease was reported as of very considerable importance in these states.

On the other hand scab was unimportant in the Northwest in 1922. In Montana it was said to be "of no account except where spray schedules have been neglected." In Idaho, according to Hungerford, scab was found only in a few instances in the northern part of the state. In Washington the disease was said to be "less prevalent and less severe than usual," and in Oregon, while it was general in the Coast section, infection was apparently very light in other apple growing regions.

South Carolina, Mississippi, and North Dakota also report the disease as unimportant. (See also Pl. Dis. Bul. 6. 1922)

Losses from apple scab are indicated in figure 39.

Weather relations

As has been said before (p.273), collaborator's reports indicate that the spring weather conditions were exceptionally favorable for the scab fungus in the regions where the disease was so prevalent. The early maturity of the ascopores and their early discharge induced by early spring rains, lengthened the period when primary infections were possible, and greatly increased the difficulty of control. In addition, unfavorable weather often prevented proper timing of sprays, thus aiding further the spread of the disease. Moreover, in many cases weather conditions favoring the fungus extended late into the season. Tennessee, Ohio, and Illinois, however, report that while the disease was favored by the spring weather, its spread was somewhat checked later by unfavorable conditions.

In the Northwest, where scab was unimportant, Idaho and Oregon both report a dry spring; while in Montana, according to Jennison, spring weather conditions were favorable to the disease.

Following are some typical or especially interesting reports made by collaborators. (See also Pl. Dis. Bul. 6: 14, 31, 73, 102, 156. 1922.)

Vermont: Weather conditions very favorable to its start in May and its spread in June.(Lutman.)

Massachusetts: Moisture conditions ideal for infection and development of scab.(Osmun .)

Delaware: Weather conditions in July were favorable for secondary infection.(Adams.)

West Virginia: Lack of prolonged rainy periods resulted in no one heavy infection, but several waves occurred. (Giddings.)

Indiana: Very heavy rains in March and April favored scab. High temperatures in March and cool rains in April and May favored infection. Early spring rains prevented proper timing of sprays and protracted cool weather at blossoming time caused this period to extend over several weeks so that proper timing of sprays was still further complicated. (Gardner.)

APPLE - Scab (ascospore discharge)

Wisconsin. Rained at night time for spring and summer infection. July rains especially important in Door County. (Vaughan.)

Ascospore discharge

Ascospore discharge is being more extensively studied in connection with apple scab control. The data submitted in 1922, in general, indicate that in addition to beginning earlier, the period of ascospore discharge lasted throughout the usual season and even longer. Reports from Delaware, Virginia, and Ohio state specifically that this period was unusually long. Because of this condition a greater amount of primary infection upon fruit would be expected, although from the information supplied it is impossible to determine whether this was really the case. The early and extended period of ascospore discharge is quite significant in connection with the favorable weather conditions reported, as well as the greater prevalence of the disease. The following list gives the dates of ascospore discharge as reported by collaborators.

March 28 - - - - - - - - Seaford, Del.
April 5 - - - - - - - - Urbana, Ill.
April 18 - - - - - - - - Woodside, Del., Winchester, Va.
April 20 - - - - - - - - Orleans Co., N.Y. (ascospores mature)
May 2 - - - - - - - - - Massachusetts
May 8 - - - - - - - - - Minnesota (mature perithecia)

Table 80. Comparative summary of data on ascospore discharge obtained in apple orchards at Seaford and Woodside, *Delaware, and at Winchester, Virginia.

Event	Date		
	Seaford	Woodside	Winchester
Bud opening	Mar. 27	Apr. 1	---
First ascospore discharge	Mar.28-Apr. 1	Apr. 18-21	Apr. 18-21
Second ascospore discharge	Apr. 5-9	May 4-15 (max.)	May 3-5
Third ascospore discharge	Apr.12-17(max.)	May 16-20	May 10-18
Subsequent ascospore discharges	Apr.19-27	** ---	May 26
	May 3-11	---	June 3,4
	May 13-20	---	June 11
	May 29-June 1	---	---
Last date on which ascospore discharge was observed	June 1	**May 26	---
First scab infection	May 10(fruit & leaves)	#May 16(leaves)	About middle of May (fruit)
Spray			
Delayed dormant	Mar. 22	Apr. 3	
Pink	Apr. 10	Apr. 11	
Calyx	Apr. 20	Apr. 29	
Seven day	Apr. 27	---	

*In Delaware data obtained from a series of five slides exposed in each section, in Virginia 10 slides were used. Reporters: Delaware, Adams; Virginia, Schneiderhan.
**No data taken after May 27
#On leaves; had been established for some days

Krout makes the following comparison between 1921 and 1922 of the dates of significant events in connection with apple scab in Massachusetts.

Year	First ascospore discharge	Last discharge	First symptoms on foliage
1921	April 28	June 10	May 12
1922	May 2	June 15	May 18

Detailed data on ascospore discharge which were collected in Delaware and Virginia are summarized in table 80, and table 81 gives the departures from the normal precipitation and temperature during the months of March, April, May, and June, at the stations where the observations were made. The ascospore discharge indicated in the first table is closely associated with rainy periods. It will be observed that the precipitations for April and May (which were the maximum primary infection periods) were below normal. However, the rain occurred, for the most part, during periods of from two to six days, and at a time when the trees were growing rapidly. It is obvious that a rainfall which is, as a whole, below normal, may be as favorable for a scab epiphytotic as one above normal, if it is properly distributed, that is, in periods of a few successive days during the time of progressive leaf development.

Table 81. Summary of monthly departures from the normal in precipitation and temperature at Seaford and Woodside, Delaware, and Winchester, Virginia.

Place		Month			
		March	April	May	June
Seaford	Rainfall (in.)	+0.54	-1.27	-1.83	+0.5
	Temperature °F	+0.26	+1.9	+1.5	+3.1
Woodside	Rainfall (in.)	+0.19	-1.48	-1.85	-3.6
	Temperature °F	+2.7	+0.8	+0.8	+1.0
Winchester	Rainfall (in.)	-0.83	-2.54	-0.5	-0.9
	Temperature °F	+2.6	+1.5	+0.6	+1.8

APPLE - Scab (growth relations)

Infection and control in relation to growth

The initial ascospore discharge producing infection can be found indirectly by numbering and dating the leaves unfolding from the leaf or flower buds according to the time of their emergence, and watching them for scab infection. Allowing the necessary length of time for the incubation period, the approximate date of infection can be determined. If this date is compared with those of spray applications, it may indicate the reason for a failure in control.

As observed in Delaware, primary infection upon leaves of new shoot growth occurred in definite zones, indicating the coincidence of ascospore discharge and growth development. Primary infection apparently occurred only on the young growing leaves. The first leaf showing such infection was always from the leaf bud, usually the fifth or sixth in origin, and was unfolding about the time of the calyx (petal-fall) spray, completing its growth before the next application in two weeks. The increase in size of this leaf, from the time it unfolded to completion of growth, averaged 11.6 to 12.88 square millimeters.

Measurements were also made of the fruit growth of Stayman and Jonathan apples between the two weeks spray after petal-fall (April 20) and the second codling moth application (July 7), with the following results:

		April 20		July 7	
		Minimum	Maximum	Minimum	Maximum
Jonathan -	length (mm.)	9.5	14	40	45
	breadth (mm.)	7.0	12	50	50
Stayman -	length (mm.)	8	13	33	47
	breadth (mm.)	6	9	33	63

These measurements show the extent of uncovered fruit surface which may develop between two spray applications, and emphasize the necessity of thorough protection during this growth period. In many instances a spray is put on between these two dates. There is evidence, further, that climatic conditions may so influence the periods of ascospore discharge and tree growth that the important spray application this year may be either earlier or later next year. Information of this nature is important in explaining the inconsistent results of scab control operations even within a single state.

Dates of first appearance, as reported by collaborators, 1922

Observations on the first appearance of scab are of little value unless accompanied by the dates of some definite stage of growth, such as the pink or petal-fall, of a specified variety. If such data were available, interesting correlations could be made for the commercial apple producing regions.

April - - - - Arkansas
April 24 - - Urbana, Ill.
April 27 - - Columbia, Tenn.
April 29 - - Ottawa, Kans.
May - - - - Delaware Co., O.
May 4 - - - West Virginia
May 10 - - - Bridgeville, Del.
May 11 - - - Lovingston, Va.
May 12 - - - Middlesex Co., Mass.
May 12 - - - Genesee Co., N.Y.
May 13 - - - Walhalla, S.C.
May 19 - - - Franklin Co., Ind.

APPLE - Scab (susceptibility)

May 5 - - - Adams Co., Pa.
May 5 - - - Ramsey Co., Minn.
May 8 - - - Madison, Wis.
May 24 - - - New Boston, N.H.
June 8 - - - Jackson, Mo.
June 15- - - Vermont

Varietal susceptibility

There are many factors entering into the problem of susceptibility and in many instances observations in one place are not in agreement with those in another section. The question of ascospore discharge, period of initial tree growth, and climatic conditions are, no doubt, the primary factors. The correlation of phenological data in relation to ascospore discharge with the susceptibility of apple varieties should prove interesting.

Vermont: Observations in a 750 acre orchard at Castleton, July 7. McIntosh had been practically defoliated in some cases. The severe infection was due apparently to sappy, tender growth produced by 3 pounds of ammonium sulphate to each tree, and a very wet June. As this orchard was a mixed one, the following list of varieties with disease resistance is of interest: McIntosh, foliage with scab and about two-thirds dead or dropped, no fruit; Northwestern Greening, leaves and fruit affected badly; Delicious, fruit badly scabbed, a little on foliage; Northern Spy, Wolf River, and Alexander Red, fruit affected only; Duchess of Oldenburg, free from scab of fruit and leaves. (Lutman.)

Connecticut: Bad on McIntosh, Fall Pippin, and Crab apple. Medium on Gravenstein and Smokehouse. Little on Red Astrachan, Delicious, Greening, and Baldwin. (Clinton.)

New York: Susceptibility in order (Ulster County), McIntosh, Banana, Northern Spy, Gano (Black Ben Davis), Winesap, Stayman, and Greening. (Chupp.)

Delaware: Delicious, Nero, Williams, Jonathan, Yellow Transparent, Strawberry, Stark, Stayman Sweet, Early Ripe, Red June, and Ben Davis. (Adams.)

Virginia: See orchard disease survey reports, page ____.

Kentucky: Yellow Transparent, Wealthy, Benoni, Maiden Blush, Grimes, Northern Spy, comparatively free. Winesap, Stayman, York Imperial, Delicious, commonly severe. (Valleau and Magill.)

Tennessee: Yates and Stayman very resistant. Mammoth Black Twig and Winesap, heavy scab infection. (Hesler.)

Indiana: Bad on fruit of Grimes, a variety usually immune to this disease from commercial standpoint. (Cullinan.)

Scab caused an early defoliation of a young Grimes orchard in Marion County, and killed many of the trees outright (some of the weaker trees.) The yield was reduced from 20 bushels per tree to one peck. (Burkholder.)

Observations on varietal susceptibility, orchard in Morgan County. Northwester Greening, foliage fairly resistant but fruit badly scabbed; Stark, Wealthy, Benoni, Chenango, Ben Davis, and Jonathan, severe on leaves and fruit; Winter Maiden Blush, scab especially severe on petioles; Grimes, small amount of scab on leaves; Yellow Transparent, no scab on leaves; Maiden Blush, some scab on leaves; Indiana Favorite, scab on leaves; York Imperial, mild on leaves and fruit. (Gardner.)

Control of apple scab

Spraying for scab, 1922

Because of the serious outbreak of apple scab, considerable data has been submitted by the collaborators, on control. In most instances results indicate that the pink spray is all-important in the initial control. Of additional interest is the increasing importance of a pre-pink spray in some states.

Maine: Have seen one orchard where excellent control, even on McIntosh was obtained. This orchard was sprayed last fall with copper sulphate solution after the fruit was harvested and then sprayed with lime-sulphur in the usual way this season. Unsprayed Ben Davis apples gave over 75% scabby fruit, while thorough spraying reduced the amount to less than 20%. (Morse.)

Massachusetts: The pink bud and calyx sprays seem to be most important. Liquid lime-sulphur, dry lime-sulphur, and lime sulphur and Bordeaux, using the latter for the pink bud application, appear to have given equally good results. (Osmun.)

New York: Nearly all commercial orchards were well sprayed, but where the spray applications were delayed or not well applied, the scab did serious injury. (Chupp.)

Virginia: Some of the spraying has been poorly done and frequently important applications have been omitted. In the best sprayed orchards, scab has been held satisfactorily and in our experimental work it has been reduced to a negligible amount in the plots receiving the field schedule of applications. (Fromme.)

West Virginia: Have observed some striking examples of heavy infection where pink spray was omitted, especially in central and western sections of state. (Sherwood.)

Ohio: Effect of reduced spraying during season of 1921 is very manifest by increased scab infection in nearly every orchard. (Thomas.)

Indiana: The pink spray and petal fall spray will not control scab in Indiana. The pink is too late and it is necessary to apply an additional "pre-pink" spray to obtain satisfactory control. (Gardner.)

Michigan: Pre-pink or delayed dormant demonstrated this year as very essential for control. (Coons.)

Studies made in 1920 and 1921 are said to have indicated that scab infection occurs previous to the time the pink cluster application of fungicides is usually made. As spore discharge studies indicated that an earlier spraying should be adopted, applications of lime-sulphur solution (one and one-fourth parts to 50 of water) were used according to the regular schedule with additional application before the buds had separated in the clusters. The pre-pink application was made about two weeks before the buds were in the condition generally called the pink state, and the results obtained showed that the earlier application is very desirable for the best control of apple scab, particularly in case of susceptible varieties. (Dutton and Johnston.)

The efficiency of the early spray in scab control was determined under Virginia conditions this year by Schneiderhan who reports as follows:

APPLE - Scab (control)

Table 82. Showing the efficiency of scab spraying and the relative values of the different scab sprays on old time Winesaps. Experimental plots, Winchester, Virginia, 1922.

Spray omitted	Percentage of scab	Spray omitted	Percentage of scab
Green tip	10.6	All omitted (check)	99.0
Pink	54.6	None omitted	7.5
Two weeks	23.9		

The relative value of these scab sprays on the basis of 100% is as follows: Green tip 3%, pink 41%, calyx 33%, and two weeks 12%.

Last year in Orleans County, New York, a demonstration was established to prove the value of the pre-blossom spray for scab control as follows: (News Letter, April 17, 1922.)

Trees receiving:	No spray	All sprays	All except pre-blossom
Percent scab	19.3	1.4	5.6

Dusting for scab, 1922

Massachusetts: In 1922 dusts were positively as effective as the spray materials. Sulphur dusts and copper lime dusts were tested. The former was more satisfactory than the latter as it did not russet the fruit or burn the foliage. (Krout.)

Connecticut: Spraying more effective this year, as before, than dusting. (Clinton.)

Indiana: In Miami County, Professor Cullinan found sulphur dust ineffective as a scab control in comparison with lime sulphur spray. (Gardner.)

Michigan: Dusting not successful generally. (Coons.)

British Columbia: We have... found under West Kootenay conditions that finely divided sulphur dust, used alone, was of little value in the control of apple scab during three seasons' tests. This may be due to the fact that under the conditions of the test the addition of lead arsenate was not called for to combat insect pests and there may consequently have been a loss of adhesiveness. Much more promising results have been obtained with the dry Bordeaux mixture made with de-hydrated copper sulphate and commonly known as Sanders' Copper Dust. While it has not given as good control of apple scab under Kootenay Lake conditions as with liquid Bordeaux or liquid lime sulphur, still the resulting crop was fairly clean, the cost much the same and the rapidity of application much greater. So far as fungous diseases are concerned, it is quite likely that dusting could replace spraying with advantage and convenience to the grower. So far as I can see, the limiting factor to its general application at present is the control of certain sucking insects. So long as a liquid spray is necessary for this purpose, so long will dusting remain of secondary importance since it is only the large grower that can afford to invest in two sets of machinery for the control of pests and diseases. (J. W. Eastham [2])

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Blotch caused by Phyllosticta solitaria E. & E.

During 1922 the reports upon blotch do not indicate any great progress northward although it was reported from Wisconsin for the first time. The general increased prevalence over previous years should be of immediate concern to the pathologist, particularly the extension pathologist, in extending greater efforts on publicity of the disease and control measures. In Mississippi blotch was reported as very prevalent and severe, especially in the northern counties and also in certain southern counties, being probably the most serious apple disease encountered in the state. It was found frequently on nursery stock, both in and out state nurseries (Neal). Illinois reports it especially severe in the central part of the state where a few years ago it was unknown (Anderson.) The disease is distinctly worse in southern and southwestern Ohio (Thomas). Delaware reports that blotch appeared in epidemic form throughout the state. Leaf infection in one orchard of the Yellow Transparent variety caused early

defoliation. Orchardists experienced greatest loss with the early varieties. (Adams.) Indiana reports blotch as the worst disease on susceptible varieties of apples (Gardner).

The generally increased prevalence of apple blotch is indicated in Table 83. Climatic conditions were generally reported favorable to the disease and appeared to be more conducive to the development and dissemination of the fungus. The neglect of spraying in 1921 must also be considered as a factor in this increased prevalence.

Table 83. Prevalence of blotch in 1922 as compared with 1921.

Amount of blotch in 1922	States reporting
More than 1921	Pennsylvania, Delaware, Maryland, Virginia, Kentucky, Tennessee, Mississippi, Ohio, Wisconsin, Iowa, Nebraska, Kansas, Texas
Same as in 1921	New Jersey, Louisiana, Arkansas, Indiana
Less than in 1921	West Virginia, South Carolina, Illinois, Missouri

Table 84. Showing estimated percentage loss from blotch for 1921 and 1922.

State	Estimated percentage loss		State	Estimated percentage loss		State	Estimated percentage loss	
	1921	1922		1921	1922		1921	1922
N. J.	Same	Same	Tenn.	5.	8.	Ind.	2.	2.
Pa.		More	S. C.		Less	Ill.	7.	6.
Del.	0.5	3.0	Miss.	4.	6.	Wis.		More
Md.	1.0	1.5	La.	Same	Same	Iowa	t	3.
Va.	t	2.0	Tex.	-	2.	Mo.	3.	t
W. Va.	1.	t	Ark.	3.	3.	Nebr.		More
Ky.	5.	35.	Ohio	2.	5.	Kans.	5.	10.

Losses from apple blotch infection

The direct loss from this disease is generally from rendering the fruit unmarketable. Fruit blemishes and cracking are often followed by secondary pathogenes producing a soft rot. Underdeveloped fruit is commonly found, resulting from leaf infection, defoliation, and cankers. An indirect loss that is difficult to estimate is associated with the devitalizing effect upon the tree for the succeeding year's crop, because of the leaf and twig infection.

The highest estimated loss is reported from Kentucky, and it is obvious in consulting Table 79 that because of the larger crop, the total loss for the state will be materially more than last year.

APPLE - Blotch

Initial infections reported by collaborators

Reports on the first appearance of the disease are of little importance unless it is designated as fruit or leaf infection on a specified variety. Reports on the main, rather than the initial, infection, are doubtless of more importance. Careful data on this subject should prove of general importance for the blotch region. The reports on the fruit infection of apple blotch occur between the period extending from May 20 to June 26 with the majority of reports indicating infection during the first two weeks in June.

Walton and Orton[2] report upon experiments in southern Pennsylvania as follows:

> "Bagging experiments on unsprayed Smith Cider trees in Adams County prove that infection by Phyllosticta solitaria started very early in the spring of 1922. Young apples bagged continuously from May 23 (17 days after petal fall) until August showed 64% blotch, indicating that initial infection occurred prior to May 23. Infection on peticles and leaves was just noticed on the bagging date (May 23) but was not noted on the unbagged fruit until June 13 when the largest spots measured 4mm. in diameter. Because of the slow development of the disease, these spots must have been visible for at least a week prior to this date. This brings the time of probable initial infection on fruit at least 10 days prior to the time usually recommended for applying the first spray."

The time of initial infection will vary considerably on different varieties, since the twigs of many varieties showing fruit susceptibility are not attacked. This fact has a fundamental bearing on the spray schedule. It was observed in Delaware that while the initial infection upon fruit was found June 7, the greatest injury to fruit occurred during July, which month was characterized by an abnormally heavy precipitation.

Weather relations

In the blotch region temperature conditions were generally higher than last year during the spring and early summer, and rainfall was rather well distributed and generally favorable for development and dissemination of the fungus. Gardner reported that weather conditions in Indiana were favorable for blotch during April, May, and June in the blotch regions and temperatures were above normal for the period March to June, inclusive.

Dissemination

Infected nursery stock appears to be an important source to guard against through which blotch may become further established, particularly in the northern sections of our fruit belt. Gardner states that cankers in abundance have been found on apple seedlings imported from Kansas by nursery-men. Cankers have been found commonly on apple nursery stock of susceptible varieties and even on Grimes. Evidence of the spread of the disease by nursery stock is accumulating.

Varietal susceptibility

The following data indicate the varieties of apples reported by collaborators showing blotch infection:

New Jersey. Severe on Smith Cider (Cook, Sept. 1)

Pennsylvania: Smith Cider, Baldwin, Jonathan, Krauser. Spreads late in the season from Smith Cider. (Thurston)

Delaware: Smith Cider, Northwestern Greening, Wealthy, Nero, York Imperial, Transcendent, White Doctor, Rhode Island Greening, Jefferis, Pewaukee, Red Astrachan, Oldenburg (Dutchess), and Transparent. (Adams.)

Virginia: Limbertwig, Shockley, Northwestern Greening, Ben Davis, Smith Cider, Paradise Sweet, Yellow Newton, York Imperial; no infection on Stayman or Winesap. (Fromme.)

West Virginia: Northwestern Greening, Oldenburg (Dutchess), Baldwin, Stark, Rome Beauty, Ben Davis, Esopus (Spitzenburg). (Giddings.) Crab Apple (Sheldon.)

Kansas: Ben Davis is badly blotched. Commercial men don't feel that combat is entirely satisfactory. (Stockdyk.)

Kentucky: Ben Davis, Rome Beauty, Maiden Blush showed severe infection; King David, Arkansas Black, Jonathan, Wealthy, Winesap, and Stayman less infection. (Valleau.)

Tennessee: Transparent, Early Ripe, Winesap, Stayman - resistant; Ben Davis, Early Harvest, Oldenburg. (Hesler.)

Arkansas: Ben Davis, Grimes, Oliver, Missouri Pippin, Limbertwig, Maiden Blush. (Elliot.)

Indiana: Fruit infection: Winesap, Esopus, Winter Maiden Blush, Wealthy, Indiana Favorite, White Pippin, Jersey Black, Smokehouse, Gideon, Salome, McAfee, Lawver, Kinnaird, Akin, Benoni. Canker infection: Wealthy, Grimes, Rome, Willow Twig, Missouri Pippin, Oldenburg (Dutchess), Transparent. (Gardner.)

Apple blotch control

One of the new features in blotch control is the emphasis on canker eradication. "The abundance of cankers on the trunks and limbs of young trees of such varieties as Dutchess and Transparent and the ease with which these can be cut out with a knife has led to extensive cooperative tests in Knox County, Indiana, aiming at complete eradication of blotch from young orchards by (1) canker excision, and (2) application of the blotch sprays at petal fall, 2, 4, and 6 weeks. Results of first season very encouraging." (Gardner.) Gardner and Jackson[2] further report that cankers on young trees of such varieties as Oldenburg can be easily cut out with a sharp knife in early spring without injury to the underlying cambium. Healing occurs rapidly and no wound dressing

is necessary. There is little danger of reinfection if all of the discolored bark is removed and if the cut is made at least a centimeter in advance of the visible margin of the canker, particularly on each side. The application of blotch sprays in nurseries and the use of blotch-free stocks and scions is much to be desired.

Additional reports on blotch control indicate the efficiency of Bordeaux mixture as well as commercial lime sulphur.

New Jersey: Experiment with commercial lime sulphur for blotch control is reported as follows from the Department of Plant Pathology. The location and variety concerned are not mentioned nor data upon yield counts.

Spray schedule: (1) Dormancy, (2) April 18, (3) May 8, (4) May 16, (5) May 26, (6) June 14, (7) July 24.

Block 1: Regular spray schedule
Block 2: Accessory spray June 26
Block 3: Accessory spray June 26, July 6
Block 4: Accessory spray June 26, July 6, and 24.

Results of apple spraying: (percentages)

	Clean	Salable	Unsalable
Block 1	7.6	49.1	43.2
Block 2	3.3	51.6	17.0
Block 3	53.8	38.5	11.3
Block 4	52.8	33.4	13.3

Delaware: Perfect control of foliage and fruit was secured with Bordeaux mixture 4-4-50 strength at the pink, petal fall, and 1, 2, and 3 weeks after petal fall on a block of Dutchess (Adams).

Ohio: The thorough going work of the apple growers applying the spray control developed by the Extension Service under Prof. F. H. Beach, has shown complete success, even with such susceptible varieties as Smith Cider and Mann. (Selby).

Beach[1] recommends a 3-5-50 Bordeaux on varieties like Ben Davis and Smith Cider at 2, 4, and 6 weeks after petal fall. Dormant pruning to open up dense portions of the tree and to eliminate dead and cankered wood, and spring application of nitrate of soda fertilizer is also recommended.

Literature

Cited:

1. Beach, F. H. Results of apple blotch control in southern Ohio. Trans. Indiana Hort. Soc. 1919: 63-72. 4 fig. 1920.
2. Gardner, Max W. and H. S. Jackson. New aspects of apple blotch control. (Abstract) Phytopath. 13:44 Jan. 1923.
3. Walton, R. C. and C. R. Orton. Time of apple blotch infection for 1922 in southern Pennsylvania. (Abstract) Phytopath. 13:43-44. Jan. 1923.

APPLE - Bitter rot

Not cited:

Freiermuth, W. Blister canker and apple blotch. Bien. Rep. Kansas State Hort. Soc. 36 (1920-21) : 140-145. 1922. Practical suggestions for control.

Bitter rot caused by Glomerella cingulata (Stonem.) S. & von S.

In 1922 bitter rot appeared to be confined principally to the Atlantic and North Central group of states except in Tennessee, Missouri, and Arkansas. There are no indications of a general epiphytotic but the increased prevalence in Delaware, Maryland, Tennessee, South Carolina, and Missouri indicate regional outbreaks of infection. In Figure 40 are summarized the data from collaborators on the prevalence of bitter rot as well as the estimated percentage losses for the seasons 1922 and 1921. Reports do not indicate that any increased prevalence is associated with hold-over cankers due to last year's neglect of spraying. High temperatures and abundant rainfall are usually found associated with the severe occurrence of bitter rot. In some instances early seasonal outbreaks of the disease are checked because of subsequent drouth. The regional outbreaks are reported to be associated with very favorable climatic conditions. It is peculiar to this disease that the period during which the fruit may become subject to infection is longer than is the case with blotch or rust, lasting from June to harvest time throughout the bitter rot belt. Because of this fact, regional treatments for control will be different. It would prove of special interest if reports would include data regarding recommendations and general practices for the preventing of outbreaks of bitter rot.

Dates of first appearance of bitter rot in 1922 according to collaborators.

June 7	Harrison	Arkansas
June 12	Columbia	Tennessee
June 16	Newark	Delaware
June 27	Bedford County	Virginia
June 27	Ross	Ohio
July	Elberfeld	Indiana
July		Massachusetts
July 22	Stonefort	Illinois
July 26	East Kingston	New Hampshire
July 28	Corinth	Mississippi
August 2	Ulster County	New York
September 1	Westville	Connecticut

Weather conditions are, no doubt, correlated with the initial appearance of this disease as indicated in collaborators' reports.

Delaware: Bitter rot was very severe following the excessive rainfall in July. (Adams.)

West Virginia: This is the first season that bitter rot has appeared in any appreciable quantity in the important fruit growing counties of eastern West Virginia in my observations in the last

nine years. (Berg.)

Tennessee: Report indicates a high temperature with wet weather early and dry later. Period of greatest injury, July 1-15 and September 1-15. (Hesler).

Arkansas: Moist, warm weather. Infection started early and looked serious, but was checked by drouth. (Elliott).

Indiana: August, September, and October period of greatest injury. Heavy local rains July 23 and 30 accompanied by high temperature started the trouble. (Gardner.)

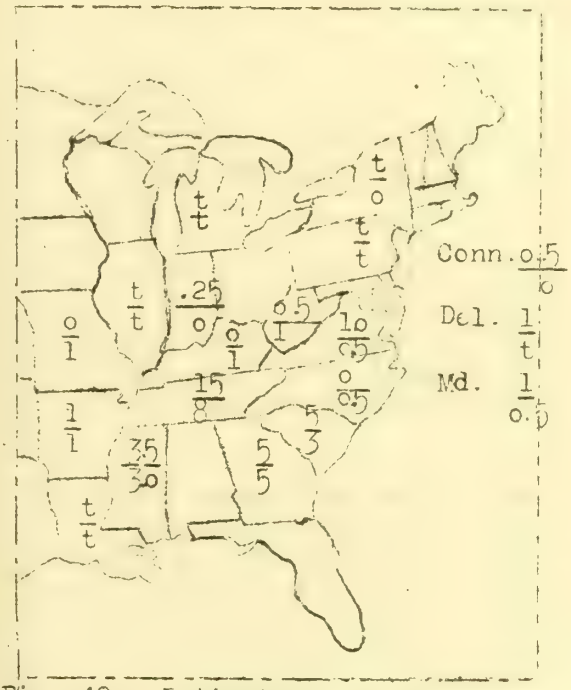

Fig. 40. Estimated percentage losses from bitter rot, 1922/1921.

Table 85. Comparative prevalence of bitter rot in 1921 and 1922.

Amount of bitter rot, 1922	States reporting
More than 1921	Conn., N.Y., N.J., Del., Md., Va., Tenn., S.C., Miss., Ind.
Same as in 1921	N.H., Mass., Pa., Ga., La., Ark., Texas, Ill., Mich., Iowa.
Less than 1921	W. Va., Ky., N.C. Ohio, Mo.

Varietal susceptibility

No extensive data was submitted this year upon susceptibility but the following notes on varietal infection were supplied:

Massachusetts: Most common on summer varieties (Osmun).

New York: A very large loss was sustained in one Ulster County orchard on Greening variety - $1,600. (Chupp).

New Jersey: In one orchard of Gravensteins examined in Monmouth County, 50% of the fruit was a total loss. (Department of Plant Pathology).

Delaware: Maiden Blush, Yellow Transparent, Chenango, Nero, Stark, Rome, Stayman, Wealthy, Grimes, Banana. (Adams).

Virginia: Yellow Newton, York Imperial, Winesap, Black Twig, Ben Davis. (Fromme).
Bedford County: York Imperial, Winesap, Yellow Newton, Ben Davis, Black Twig, Cannon, Stayman, Paradise Sweet. (R. H. Hurt).

Tennessee: Early varieties heavily infected. In some cases these early infected varieties were left on trees and furnished source for later varieties which also rotted. Jefferis and York Imperial, very susceptible. (Hesler).

Arkansas: Grimes, Ben Davis, King David, Jonathan. (Elliott).

Indiana: Grimes, Stayman, Rome. (Gardner).

Bitter rot control

Very meager notes are submitted regarding control measures. It would prove of special interest if collaborators would submit more data on this subject.

Delaware: Orchardists who failed to apply a July spray had severe infection. The July spray is recommended during the first week of the month, which is important for coddling moth, bitter rot, apple blotch, sooty blotch, fruit spot, etc. Dusting with copper arsenate dusts failed to control in orchards observed. (Adams).

Indiana: An orchard sprayed 7 times, 5 with Bordeaux mixture 4-6-50, failed to control bitter rot on Grimes, Stayman, and Rome, because of failure to spray until the last part of July. The difficulty is that Bordeaux mixture russets Grimes badly, so cannot be used. Growers in southern Indiana prefer to take a chance on bitter rot rather than spoil their fruit with the spray. (Gardner).

Blister canker caused by Nummularia discreta Tul.

Blister canker was reported in 1922 from practically the same regions as in the past years and in addition, as having been found for the first time in Wisconsin. There is no indication of the disease being on a general increase except in Illinois. Gardner in Indiana states that severe drouth favored destructiveness of this disease. The nature of the injury is generally reported as trunk and branch infection and Elliot reports heart rot in Arkansas. The estimated percentages of loss are given as follows: New York, none; Arkansas, 2%; Indiana, 1%; Illinois, 1.5%; and Kansas, 2%. The range of infection is usually local and in most instances associated with mature and neglected trees. Occurrence reported upon old trees from Delaware, Indiana, and Missouri. Kansas reported practically every orchard has infected trees. Some orchards show 50% damage (Stokdyk). In Ohio blister canker has

been observed in most counties visited outside the Baldwin area, but appears to be rather less frequent than in earlier years (Selby). Illinois reports prevalence through most of the state and seems to be increasing in abundance. (Tehon).

Varietal susceptibility is reported by states as follows:

Ben Davis:	New York, Ohio, Indiana, Illinois, Kansas.
Yellow Transparent:	Delaware, Ohio.
Red Astrakan:	Delaware.
Rome Beauty:	Ohio
Grimes Golden:	Indiana.
Missouri Pippin:	Kansas.

No data has been submitted on the result of any control measures initiated.

Literature.

Anderson, H. W. Orchard practice for the control of blister canker of apple trees. Illinois Agr. Exp. Sta. Circ. 258: 16 p. illus. May, 1922.

Freienmuth, William. Blister canker and apple blotch. Bienn. Rep. Kansas State Hort. Soc. 36 (1920-21): 140-145. 1922. Practical suggestions for control.

Black rot caused by Physalospora cydoniae Arnaud (Sphaeropsis malorum (Berk.) Pk.)

Black rot was reported from the same general region as last year, particularly east of the Mississippi, which section always experiences losses in contrast to the western fruit belt where the disease is of rare occurrence or minor importance.

The prevalence and estimated percentage losses are, generally, much less than in 1921, when black rot was second in importance to scab in actual loss caused. The lower importance of the disease in 1922 is no doubt correlated with the more favorable spring temperatures for tree growth and with thorough spraying. Shoot growths were killed in many sections in 1921 by the spring freezes and spraying was generally neglected with the result that leaf and twig infection became seriously established. Thorough spraying in 1922 materially assisted in checking infection from the favorable hold-over from the preceding season. In certain years it is not uncommon to find serious leaf infection following seasons when fire blight has been prevalent.

Nature of injury from black rot

The nature of the injury this year is reported under three types: viz., leaf infection, twig cankers, and fruit rot (secondary). Leaf infection is prevalent in neglected orchards and closely associated with dead twigs where the fungus has over-wintered, and was generally observed during the latter part of April and the first part of May. Fruit rot follows insect, frost, and spray injury, as well as scab and blotch infection of the apple. Reports of the market inspection service show decay due to black rot ranging from 2 to 20%, from small spots to complete decay.

APPLE - Black rot

Table 86. Relative prevalence of black rot in 1922

Amount of black rot, 1922	States reporting
More than normal	N.H., Conn., N.Y., Pa., Tenn., Ark.
Normal	Vt., Mass., N.J., Md., Ga., Ind., Ill., Mich., Wis., Minn., Iowa
Less than normal	W. Va., Va., Ky., S.C., Miss., La., Texas, Okla., Ohio, Mo.

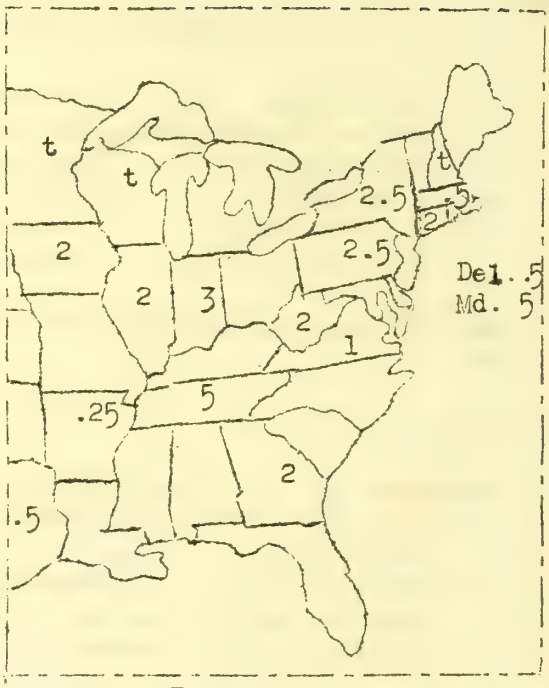

Fig. 41. Estimated percentage loss from black rot in 1922.

Delaware: Leaf spotting most prevalent on Yellow Transparent. This is usually associated with infected twigs where the fungus has over-wintered. (Adams).

Virginia: Chiefly fruit rot following arsenical injury at calyx end, also some twig infection. (Fromme).

West Virginia: About usual amount observed so far on fruit. Better spraying generally than last year, apparently reduced damage following worm injury, but considerable infection locally due to frost injury at calyx. Leaf spot exceedingly heavy in some places. (Sherwood).

Arkansas: The leaf spot form of this disease was more severe in Arkansas when I made observations in June than I have ever seen it any year in the fourteen years that I have been working on apple diseases. It was particularly severe on trees weakened by scale. (J.W.Roberts).

Ohio: The spore discharge of black rot was noted to be coincident with that of apple scab. Serious defoliation reported from southern Ohio. (Thomas).

Indiana: In well kept young orchards cankers are absent. Black rot occurred commonly as a fruit rot following blotch on Northwestern Greening, Oldenburg (Dutchess), and Ben Davis, and following scab.

Typical calyx end rot noted on Ben Davis, October 20. Much shallow bark infection on Ben Davis trees in orchards in Miami County, abundant source of infection for fruit. (Gardner).

Illinois: Present so far mostly as leaf spot. Unusually abundant where treatment has been neglected. In many orchards 60% of the leaves on the trees are infected with a reduction of leaf surface varying from 5-30%. More serious southward. (Tehon.)

Varietal susceptibility

Massachusetts: Baldwin, Greening, Northern Spy, especially susceptible. (Osmun).

New York: Ulster County - Baldwin, Ben Davis, Jonathan, Esopus (Spitzenburg). (Chupp).

Delaware: Yellow Transparent, Williams, Red Astrachan, July (Fourth of July). More prevalent upon the fruit of early varieties. (Adams).

Maryland: Williams and Red Astrachan.(Jehle).

Tennessee: Ben Davis very susceptible to fruit rot (60% end rot). Delicious resistant to rot. (Hesler)

Ohio and Illinois: Crab Apple.

Gardner submits the following observations of varietal susceptibility in an orchard in Morgan County, Indiana, October 10.

Variety	Leaf spot	Fruit spot
Northwestern Greening	Severe	Severe
Stark	Slight	Slight
Winter Maiden Plush	Slight	Slight
Wealthy	Severe	Slight
Grimes	Slight	Slight
Benoni	Slight	-
Chenango	Severe	-
Yellow Transparent	Severe	-
Maiden Blush	Slight	-
Ben Davis	Severe	Severe
Jonathan	Severe	Severe
Indiana Favorite	Severe	-
York Imperial	None	Medium

Frog eye and black rot control

Very little data has been submitted with reports on the control measures this season. Under normal conditions in well kept orchards the orchard spraying program keeps this disease in check.

APPLE - Black rot

Massachusetts: Usual spray schedule holds disease in check. (Osmun).

Tennessee: The pink spray seems important to head off first infections. (Hesler).

Indiana: Neither scab nor blotch sprays seem to prevent frog-eye. On Northwestern (5-25%) abundant frog-eye spots occurred at Knightston - as much on trees sprayed with Bordeaux mixture as on control. Frog-eye spot rather abundant on young Oldenburg (Dutchess) trees in Knox County, June 1, that had been thoroughly sprayed for blotch with Bordeaux mixture at petal fall, 2, 3, and 6 weeks applications. (Gardner).

Rust caused by Gymnosporangium juniperi-virginianae Schw.

The distribution of cedar rust in 1922 conformed to areas from which it has previously been reported. There was a general increase in abundance in the North and South Atlantic states, indicated by the greater economic importance as compared with the past few years.

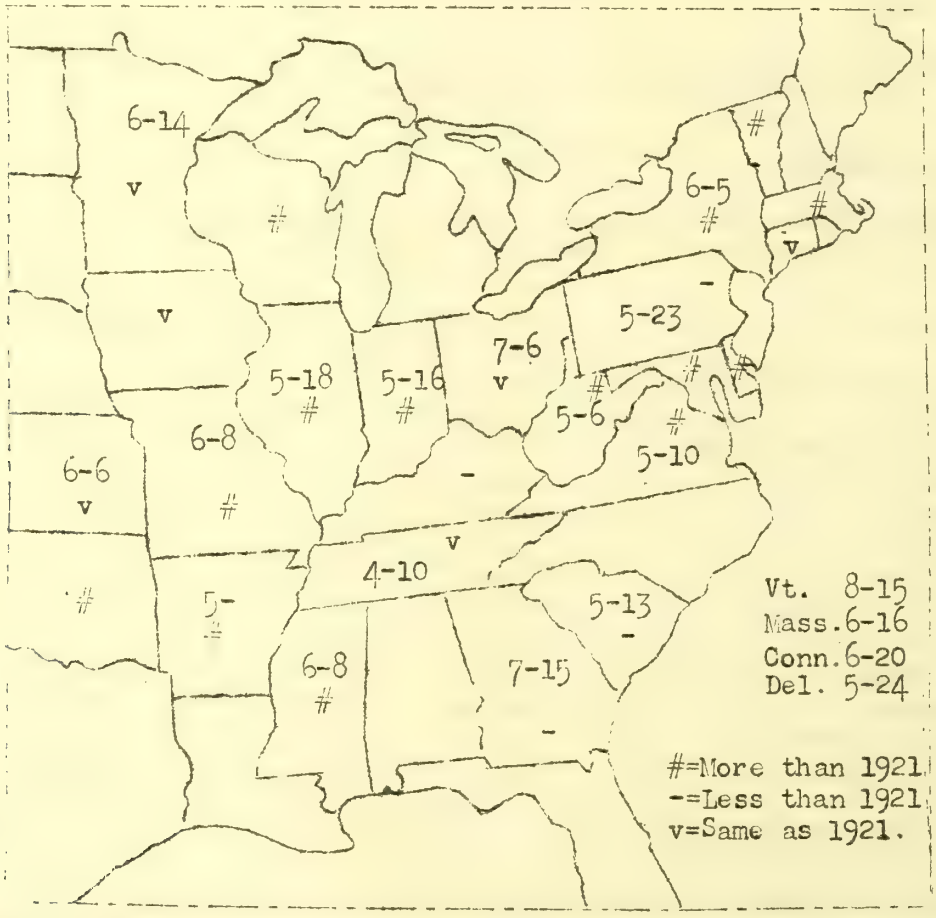

Fig. 42. Disease prevalence compared with an average year and dates of first appearance of cedar rust on apple in 1922.

APPLE - Cedar rust

The estimates of loss in the North Atlantic states are as a whole greater than those of the preceding year. In this section climatic conditions were generally favorable during April and May for the maturing of cedar apples as well as infection upon the apple. Table 87 gives the departures from the normal temperature and rainfall for these two months, together with percentage losses, in the states reporting the disease. It appears obvious that the increase in prevalence may be correlated with favorable conditions of temperature as well as of precipitation, although some collaborators mention only the latter.

Table 87. Departures from the normal temperature and rainfall for April and May, 1922, in states where cedar rust occurs.

State	Estimated percentage loss	Departure from normal: Temperature: April	Temperature: May	Rainfall: April	Rainfall: May
New Hampshire	t	+0.5	+0.9	+0.29	+1.08
Massachusetts	t	+1.0	+3.0	-1.01	+1.28
Connecticut	.5	+1.5	+3.6	-1.17	+1.22
New York	4.	+1.2	+3.2	+0.14	-0.24
New Jersey	1.	+1.5	+2.6	-1.08	-0.04
Pennsylvania	t	+1.4	+2.7	-0.50	-0.54
Delaware	1.5	+1.4	+1.8	-1.44	-0.48
Maryland	1.5				
Virginia	10.	+2.5	+1.0	-1.19	+0.38
West Virginia	1.5	+2.9	+1.8	-0.37	-0.22
South Carolina	t	+2.1	+0.2	+2.14	+2.31
Ohio	.5	+2.6	+3.3	+1.32	+1.11
Indiana	.1	+2.6	+4.3	+2.61	-0.50
Illinois	.5	+2.1	+3.8	+1.64	-0.64
Wisconsin	t	+0.1	+6.1	+1.05	-0.40
Minnesota	t	+0.1	+5.9	-0.16	-0.35
Kansas	.5	+0.3	+1.0	+2.40	+0.07
Kentucky	1.	+3.6	+2.3	+0.30	-0.08
Tennessee	t	+3.6	+1.5	+0.84	+0.57
Mississippi	t	+3.7	+1.1	-0.23	+1.34
Louisiana	t	+3.5	+1.2	-0.49	+2.45
Arkansas	t	+2.3	+1.6	+0.76	-0.12

The stage of growth of the trees should also be considered in determining variations in prevalence. Phenological data, particularly on certain susceptible varieties, would provide a more definite and exact basis for correlations. It will be noted from Fig. 42 that in most of the states where rust was more abundant than usual infection appeared during the first part of May. At this time the trees are just beginning to develop foliage. Petal fall would occur about the middle of April and infection probably take place during the latter part of April and the first part of May, according to information supplied by collaborators.

The heaviest loss - 10% - from cedar rust was reported from Virginia. Fromme stated that the disease was epiphytotic wherever cedars and apples occurred in proximity, and that fruit infection was unusually prevalent and found to some extent on all varieties. (Pl. Dis. Bul. 6:75. Aug. 15, 1922).

APPLE - Cedar rust

The distribution of the disease in Virginia is indicated on the accompanying map.

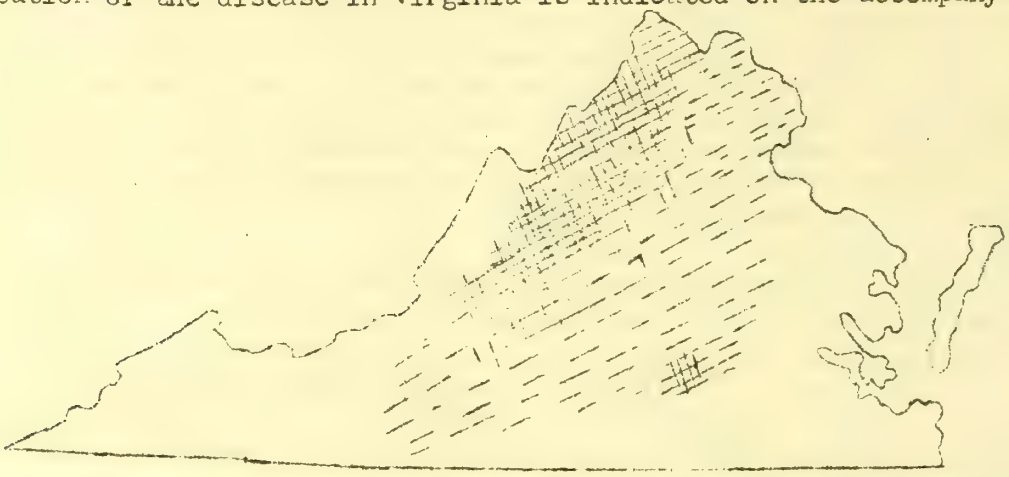

Fig. 43. Prevalence and distribution of cedar rust in Virginia, 1922.

Some interesting data on fruit infection in the state are given in table 88.

Table 88. Data on fruit infection of apple varieties with cedar rust in Virginia, 1922.

*Frederick County			#Bedford County		
Number orchards	Percent fruit infection (av)	Variety	Number orchards	Percent fruit infection (av)	
10	3.2	Ben Davis	3		0.3
		Black Twig	3		t
		Cannon	3		t
		Delicious	1		0.6
		Grimes	1		0
1	1	Northwestern Greening			
		Paradise Sweet	1		0
1	1.5	Sheepnose			
2	0.2	Stayman	1		0.4
1	1.5	Winesap	14		t
		Yellow Newtown	7		0.6
17	4.4	York Imperial	9		0.7
32	3.5	Total and average	43		0.3

* Data collected by F. J. Schneiderhan: number of fruits counted 200-500

\# Data collected by R.H.Hurt; number of fruits counted 500 in each orchard.

West Virginia also reports more fruit injury than usual. Twig infection was reported on Jonathan in Indiana, and was said to be severe on Yellow Bellflower in Missouri.

Very few reports of observations upon infection of red cedars were submitted in 1922, although it is important that careful data upon occurrence on this host, as well as on the apple, be obtained. Snell says that in Rhode Island galls on red cedars were not only very abundant but unusually large this spring.

Dates of earliest recorded appearance of cedar rust, 1922

1. Telial horns on red cedar

April 2 - - - - - - - - - Anna, Ill.

? April 10 - - - - - - - - - Chattanooga, Tenn.

April 25 - - - - - - - - - Hancock Co., Ind.
May 27 - - - - - - - - - Minnesota

2. Pycnia on apple
May 17 - - - - - - - - - Tennessee
May 18 - - - - - - - - - Olney, Ill.
June 14 - - - - - - - - - Minnesota

3. Not differentiated (probably on apple)
May 6 - - - - - - - - - West Virginia
May 10 - - - - - - - - - Winchester Co., Va.
May 13 - - - - - - - - - Walhalla, S.C.
May 16 - - - - - - - - - Harrison Co., Ind.
May 23 - - - - - - - - - Adams Co., Pa.
May 24 - - - - - - - - - Bridgeville, Del.
May - - - - - - - - - - Fayetteville, Ark.
June 6 - - - - - - - - - Wabaunsee, Kans.
June 8 - - - - - - - - - Jackson Co., Mo.
June 13 - - - - - - - - - Ulster Co., N.Y.
June 15 - - - - - - - - - Washington Co., Ill.
June 16 - - - - - - - - - Worcester Co., Mass.
June 20 - - - - - - - - - Mt. Carmel, Conn.
July 6 - - - - - - - - - Hamilton Co., Ohio
August 15 (about)- - - - Vermont

Varietal susceptibility

The information listed in table 89 was contributed by Valleau, who comments as follows:

> "The records were taken on the 22nd of August and represent fairly definitely the relative resistance of the varieties reported if they are properly named. It is a young orchard, only about 10 years old, and as a consequence all of the varieties had not been checked up because they had not yet fruited. The distribution of diseased trees throughout the orchard, I think, indicates clearly that the possibility of infection was practically identical for all the varieties."

This is an extensive list and affords an exceptionally important basis for observations on varietal susceptibility in future years.

Table 89. Amount of infection of apple varieties with cedar rust, as reported from the Kentucky Agricultural Experiment Station Orchard, 1922.

Amount of infection			
Slight	Moderate	Heavy	Very heavy
Akin	Hubbardston	Benoni	Esopus
Arkansas Black	Imperrambo	Bayard	Pryor
Early Melon	Lady Sweet	Bellflower	Rome Beauty
Grimes	Paradise Sweet	Blythe	Senator
Golden Delicious	Rambo	Cox Orange	Wealthy
Golden Winesap	Romanite	Fall Beauty	
Missouri Pippin	Stark	Fallawater	

APPLE - Cedar rust

Amount of infection			
Slight	Moderate	Heavy	Very heavy
New Zealand Spy	Smokehouse	Jonathan	
Northern Spy	Winter Banana	Lewis S.& H.	
Pewaukee	Yellow Horse	Marita	
Red June		Minkler	
Roman Stem		Mother	
Rall's Genet		Nero	
Sutton		Opalescent	
Summer Pearmain		Pipers Fall Beauty	
White Pearmain			
Wilson's Red June			
York Imperial			

No injury from cedar rust was observed on the following varieties: Alexander, Astrachan, Albemarle Pippin, Bonum, Buckingham, Baldwin, B.K.Ben, Ben Davis, Champion, Cheese, Chenango, Charlamoff, Delicious, Domine, Dartmouth, Excelsior, Early Harvest, Early Colton, Early Strawberry, Fanny, Fall Winesap, Fall Pippin, Florence, Golden Russet, Gold (crab), Gilbert Winesap, Giant Genitan, Gravenstein, Golden Sweet, Hackworth, Henry Clay, Huntsman, Hyde King, Hyslop, Ingram, Jefferis, King, Kinnard, King David, Liveland Raspberry, Limbertwig, Lowry, Lowell, Lancingburg, Mann, Mammoth Black Twig, Milan, Maiden Blush, McIntosh, Northwestern Greening, Ortley, Oldenburg, Paducah, Primate, Porter, Paragon, Reid's Early, Russet, Rhode Island Greening, Red Canada, Smith's Cider, Salome, Stayman, Star , Sweet Bough, Transcendent, Virginia Beauty, Willow Twig, Walbridge, Whitney, Windsor, Winesap, White Pippin, Wagener, Weisner, William's Favorite, Wolf River, Yellow Transparent.

A large number of varieties is reported by various collaborators as showing infection, but, owing to duplication with the list in table 89, only the following additions are mentioned: Connecticut - Twenty Ounce; New York-Boiken; Delaware - Crimson Beauty, Strawberry, July (Fourth of July); Indiana-Indiana Favorite, flowering crab; New York, Ohio, Illinois, and Minnesota - crab apple. According to Hesler, the variety Yates is resistant in Tennessee.

Control of cedar rust

Few reports were received regarding any specific control measures. Spraying is reported as unsatisfactory in Delaware and Missouri[1]. According to Adams, neither lime-sulfur nor Bordeaux mixture used in the delayed dormant, pink, petal-fall, or seven-day applications had any noticeable effect on the amount of the disease on apple trees in Delaware.

Reports on the progress of red cedar eradication in Illinois[2] and Virginia[4] have been published. The following remarks on the results of eradication or upon the relation of the disease to red cedars are interesting. (See also Pl. Dis. Bul. 6, 1922).

West Virginia: Results of red cedar eradication are excellent and show very effective control (Giddings)

Kentucky: In Boyd County this year four trees (Rome) were almost defoliated with the rust. In early August the foliage was yellow

with the rust spots. No cedar trees could be found closer than 60 rods and these were on the opposite side of a hill. The few apples on the trees were covered with rust. (Magill, Nov. 1)

South Carolina: I have not seen any bad infestations during the last three seasons. This seems odd, as the cedar is abundant and "cedar apples" are common. (Ludwig)

Arkansas: This would have been a disastrous disease this year but for the fact that nearly all cedars had been cut in the orchard district. (Elliott)

Indiana: Defoliation resulted in complete loss of crop in side of orchard next to cemetery containing 300 red cedars. Burkholder reports one bad infection due to cedars one mile away. No rust in Ben Douglas' orchard in Brown County - cedars removed. (Gardner)

Literature cited

1. Cardinell, H.A. Pl. Dis. Bul. 6:142. Nov. 1, 1922.
2. Davison, B.M., and H.H.Parke. Red cedar eradication. 4th Ann. Rept. Dept. Agr. Illinois, July 1, 1920 - June 30, 1921: 35-36. 1922.
3. Hopkins, E. F. Varietal susceptibility of the Yellow Bellflower apple to cedar rust. Phytopath. 12: 190-192. 1922.
4. Schoene, W. J. The eradication of cedar rust by the removal of cedar trees. In Thirteenth report of the State entomologist and plant pathologist. Quart. Bul. Virginia Crop Pest Comm. 34: 30. 1922.

Fire blight caused by Bacillus amylovorus (Burr.) Trev.

Fire blight was generally reported as more prevalent in 1922 than usual. Blossom and twig infection were the types most commonly occuring but in some instances fruit infection and collar blight were serious, and root rot and leaf blight were also reported.

In a number of states reporters said it was more abundant than they had ever before observed it. This was the case in Vermont, Arkansas (Becker), southwestern Michigan (Bregger), and Missouri (Cardinell) while in Massachusetts it was more common than for years, according to Osmun. Delaware reported more blight than there had been in the past three years, and in Maryland, West Virginia, and Ohio, it was said to be more prevalent than during the two years preceding. The following quotations are typical of the collaborators' reports.

Vermont: Never as abundant in my thirteen years (Lutman)

Connecticut: Not serious at all; death of young twigs in early summer and conspicuous injury. At least average amount. (Clinton)

New York: Prevalent wherever apples are grown. Very important. Second only to scab. (Chupp)

Fig. 44. Prevalence of fire blight compared with the $\frac{\text{average year}}{\text{last year}}$ and estimated percentage loss.

Tennessee: General, but of slight importance except locally, (as blossom blight). (Hesler)

Mississippi: Twig blight, no doubt, is responsible for poor or practically barren yields in many parts of the state. Many large trees bloom profusely and then blight back. Can be found in almost every orchard in the state. (Neal)

Texas: Epidemic. Appeared early as blossom blight and is quite severe at present (July 15) as twig blight, in spite of dry weather. Crop practically total failure. (Taubenhaus).

Arkansas: Fire blight was generally severe in all sections of the state. Growers everywhere report that the low, fertile lands show more blight, both on apples and pears. (Woolsey).

Montana: We have considerable blight infection all over the state this year. It has been on the increase for the past two years, but this year it is assuming serious proportions. (Shovell).

Idaho: More. Very serious in neglected orchards. More important in the northern portion of the state. (Hungerford).

The local epidemics in the various states were generally favored with moist, cool weather. Rains were more equally distributed during April, May, and June than in 1921. In some sections several successive days of rain were associated with the outbreak of the disease. In some instances it was observed that although cool weather was favorable to blight where established, it also lessened the activity of insects as disseminating agents.

Dates of first appearance

It is generally found that infection first appears during the months of April, May, and June, and occasionally in July. Infection this season was, for the most part, observed during the months of May and June. Temperature and moisture are the determining factors in the appearance of blight, while its destructiveness and spread are decided by others, including the presence of new growth, permanence of favorable weather conditions, and abundance and activity of disseminating agencies.

The greater prevalence of the blossom blight type of injury indicates a range of infection associated with the blossoming period and cool, moist weather, in the group of Atlantic states. Twig infection usually follows severe blossom infection and the new growth becomes susceptible to infection up to the time of completed growth. Severe blossom infection with favorable climatic conditions persisting will pave the way for serious twig infections. The new succulent shoot growth is subject to infection for a period of probably eight weeks. Fruit infection is quite dependent upon twig infection, and its susceptibility probably extends over a similar length of time.

Varietal susceptibility

Susceptible varieties reported by collaborators, for the most part, are the same as those in previous seasons. The early varieties, along with Jonathan, are most consistently reported. The early apple varieties illustrate a group susceptibility of special interest. Is the problem concerned

with succulent initial growth completed over a shorter growing period, compared with later varieties?

The following list gives the varieties which were reported from more than one state as affected in 1922:

Jonathan: New York, New Jersey (severe), Delaware, Kentucky[7] (very susceptible), Arkansas (Jonathan suffered most), Indiana, Illinois, Michigan, Missouri[3] (especially on Jonathan), Kansas (seemed most susceptible), Montana[8] (very seriously infected this year), Colorado.

Yellow Transparent: New York, Delaware, West Virginia (very susceptible), Kentucky[7] (very susceptible), Tennessee (very susceptible as usual), Indiana, Illinois.

Wealthy: New York, Kentucky[7] (susceptible), *Wisconsin, Montana[8].

Alexander: New York, Michigan, Montana[8] (most seriously infected)

Esopus (Spitzenburg): New York, Washington[5,6], Oregon[1,5] (most seriously affected as usual)

York Imperial: Delaware, Virginia (most blossom blight on Yorks and Pippins), Kentucky[7] (more resistant than some), Tennessee (unusually susceptible this year)

Greening: New York, Michigan.

Oldenburg (Dutchess): Indiana, Michigan.

Newtown: New York, Washington[5] (rare), Oregon[1] (some twig blight)

Rome Beauty: Kentucky[7] (susceptible), Montana[8] (one of most seriously infected)

Winesap: Virginia (little), Kentucky[7] (somewhat resistant), Indiana.

McIntosh: New York (seemed very resistant), Montana[8].

Ben Davis: Kentucky[7] (somewhat resistant), Arkansas.

Sweet varieties: Vermont (very susceptible), New York.

In addition, a number of varieties were reported from only one state:

Benoni: Illinois

Delicious: New York

Early varieties: Missouri[3]

Fall Pippin: New York

Gano: Montana[8]

Genitan: Colorado

*Golden Delicious: Kentucky[7]

Grimes: West Virginia

Hoover: Tennessee (among most susceptible)

King: New York

*McMahon: Wisconsin

Maiden Blush: Arkansas

Northern Spy: Montana[8]

Ortley: Washington[5] (rare)

Pippin: Virginia (see York)

Rhode Island Greening: Delaware

Siberian Crab: Michigan

Star: New Jersey (severe)

Stayman: Kentucky[7] (somewhat resistant)

Summer Queen: Kentucky[7] (susceptible)

Sweet Bough: New York

Tolman (Tolman Sweet): Michigan

Tompkins King (King of Tompkins): Washington[5] (next to Esopus)

Transcendent Crab: Montana[8]

Twenty Ounce: New York

Willow (Willow Twig): Indiana

Winter Banana: Kentucky[7] (susceptible)

Wolf River: New York

(*Wisconsin: source of infection in commercial orchards.
Kentucky: one tree affected, variety supposed to be immune)

Control of fire blight

In many cases it has been stated that fire blight on apples is most destructive in the vicinity of pears or the Transcendent crab or other extremely susceptible apple varieties. Because of this situation, eradication of these susceptible hosts is being considered or has already been undertaken in several states. About the most extensive of those already started is the Weston fire blight control project in Wisconsin. Vaughan states that the Transcendent crab was taken out of 36 square miles in Dunn County, where the farm orchards were almost completely cleared of this variety. Chambers[4] reports on this Weston fire blight control project as follows:

> "Of the seventy or more farmers visited, some 2,000 trees were listed of which 109 were crab apples and the majority of the Transcendent variety. The Weston Orchard Company had given the project a good start by the removal of all of their crab apple trees, about 300 in number. Every owner of one of the susceptible trees made a definite promise to remove them by spring.
>
> "Among the most susceptible varieties of apples which we urged destroyed rather than to attempt to prune, were the Yellow Transparent and McMahon. While the Wealthy is a susceptible variety, overwintering cankers do not occur on it to a serious extent, and since it is the best adapted variety for this section, one of the objects of the work was to protect it from repeated reinfection. The Northwestern Greening, on the other hand, seems less susceptible to the disease."

Shovell[8] reported that in Montana it was planned to put on a program to eradicate, if possible, the Alexander, Transcendent, and Jonathan varieties.

According to Becker[2], blossom blight was extremely severe in the northwestern apple belt of Arkansas, causing numerous complaints from the growers, who asked that the State Plant Board undertake the eradication of fire blight in that section by requiring the destruction of the pear trees. Winfrey[10], also, states that in Arkansas the close proximity of pear trees was held to be directly responsible for the presence of fire blight in apple orchards. No instance was observed where appreciable damage occurred if the apples were a mile or more away from the pears. On the other hand, Swingle[9], of the Montana Experiment Station, does not consider pear trees to be a menace to the apple industry. He thinks that they are no more liable to blight infection than apples, and that the disease is more easily controlled on pear trees because the light-colored bark permits more thorough cutting-out of infection. Another statement of interest in this connection is that of County Fruit Inspector, Mills, of Klickitat County, Washington, who said, according to Childs[5], that he had not found any pear trees affected by blight, while adjoining Esopus (Spitzenburg) apple trees were so seriously damaged as to require taking out, and other apple varieties were also infected. The disease was found on wild hawthorne and on service berry, and it was thought that the removal of the native host plants would be necessary in one section of this county before effective control could be obtained.

Regarding the relation of insects to the disease, it was observed in Delaware that very few insects were active during the blossoming period because of cool weather. Bees in particular were very inactive. While fire blight was established about two weeks later, there was no evidence of its dissemination by insects.

APPLE - Fire blight

Literature (see also under pear blight)

Cited:

1. Barss, H.P. Pl. Dis. Bul. 6: 67. Aug. 1, 1922
2. Becker, Geo. G. Pl. Dis. Bul. 6: 65. Aug. 1, 1922
3. Cardinell, H. A. Pl. Dis. Bul. 6: 66. Aug. 1, 1922
4. Chambers, E. L. The Weston fire blight control project. Rept. Wisconsin State Hort. Soc. 52: 47-51. 1922
5. Childs, Leroy. Pl. Dis. Bul. 6: 67-68. Aug. 1. 1922.
6. Fisher, D. F. Pl. Dis. Bul. 6: 33. July 15, 1922
7. Magill, W.W. Pl. Dis. Bul. 6: 154. Nov. 15, 1922
8. Shovell, W. L. Pl. Dis. Bul. 6: 72. Aug. 15, 1922
9. Swingle, D.B. Pear and apple blight in Montana. Montana Agr. Exp. Sta. Circ. 98: 10 pp. Aug. 1921
10. Winfrey, Geo. W. Pl. Dis. Bul. 6: 64. Aug. 1, 1922

Collar rot (cause undetermined)

A collar rot upon Grimes Golden is reported from Ohio, Indiana, and Illinois. In Illinois, according to Anderson, other varieties than the Grimes Golden show some type of disease, but rarely; 10% of Grimes Golden over 13 years old are affected.

Fruit spot caused by Phoma pomi Passer.

Fruit spot was reported as considerably increased in prevalence in Massachusetts, New Jersey, Delaware, and Ohio. Thomas states that in Ohio this disease is demanding more attention from year to year, apparently rivalling scab occasionally in loss caused in some orchards. The disease was also reported from Connecticut, New York, Pennsylvania, West Virginia, Arkansas and Iowa.

In many instances a slight infection of fruit spot is overlooked. Owing to the usual superficial symptoms, many orchardists under-estimate the importance of this disease. The loss due to it is often high because of unmarketable fruit resulting from heavy infection. During the average normal season, however, very little fruit spot is reported, particularly where thorough summer spraying has been conducted. The losses reported as due to fruit spot in 1922 are: Massachusetts, 1%; New York, trace to 1%; West Virginia, trace; Arkansas, one-half per cent.

The disease generally makes its appearance during July and August, when it is also most commonly reported. Favorable weather conditions, particularly favorable rains, are associated with the increased prevalence of fruit spot in 1922. There is evidence that conditions favoring fruit spot are also favorable to cloud (sooty blotch and fly speck). In Delaware it was consistently observed that the two diseases occurred under similar conditions upon the lower inside fruit, and that the appearance of both was associated with excessive rainfall in July.

There have never been any extensive reports on the relative susceptibility of apple varieties to fruit spot. The disease is often overlooked on red varieties because of its inconspicuousness, particularly where the infection is at the blossom end. In the following list are given the varieties most

often reported in 1922 as affected, with the states reporting them:

Jonathan: New York, Pennsylvania, Delaware, Arkansas, Ohio.
Grimes: Pennsylvania, Delaware, Arkansas, Ohio
Baldwin: Massachusetts, Connecticut, New York
Ben Davis: New York, Delaware, Ohio
Greening: Connecticut, New York
Mann: New York, Ohio.
Rome Beauty: Delaware, Ohio
King David: Delaware, Arkansas

In addition, several varieties were reported affected from only one state, as follows:

Connecticut: Gravenstein
New York: Pippin, Delicious, Newtown
Delaware: White Doctor, Winesap, Smokehouse, Northern Spy, Maiden Blush, Langford, Fallawater, Gilpin (Carthouse), Brandywine, Stark, Lilly (of Kent), Paragon
Arkansas: Collins

The disease was ordinarily reported as unimportant or not severe except in unsprayed or poorly sprayed orchards or trees. In Connecticut, spraying, or dusting with Saunder's dust gave much better control than lime-sulfur dust, according to Clinton. Chupp states that in New York the application of a late summer lime-sulfur spray is very effective. In Delaware fruit spot became serious in orchards not sprayed during July, and a report from Ohio (Thomas, Sept. 10) states it was first found only in orchards where no mid-July spray was applied. Infection was said to be most prevalent on the fruit on the lower inside branches of the trees, poorly covered by sprays, in Delaware and Arkansas.

Anthracnose caused by Neofabraea malicorticis (Cord.) Jackson

Anthracnose was reported from the northwestern apple belt as of slight prevalence. In Oregon it was severe where control measures are not emphasized, damage to trees in some places being estimated at 35% by the Lane County Inspector. Spraying with Bordeaux mixture once before the fall rains gives perfect control, and as a result of control campaigns, the situation is no longer menacing (Barss). In Washington it was less frequently reported than usual, due probably to unfavorable climatic conditions (Dana).

Recent literature:

White, E. W. Apple tree anthracnose or black spot canker control. Scient. Agr. 2: 186-191. illus. Feb. 1922.
_____ Control of anthracnose, or black spot canker. Better Fruit 16[8]: 7, 21; [9]: 12, 18, 19. 1922

APPLE - European canker

European canker caused by Nectria galligena Bres.

This disease was reported from New York (several counties), Washington, and Oregon. According to H. P. Barss, the disease is present throughout western Oregon, but causes no appreciable damage on most commercial varieties. (See also Pl. Dis. Bul. 6: 75-76. Aug. 1, 1922)

Zeller, of Oregon, reports as follows upon varietal susceptibility: Red Check Pippin (bad), Bismark, Delicious, Pennock, Bellflower, Esopus, Northern Spy, Greening, and Newtown (slight).

Nectria galligena and N. coccinea may both be present in the same locality and no doubt are more widely distributed than reported. Zeller[1] has recently reported that the two fungi are distinct morphologically as well as in their parasitic virulency and physiology.

Recent literature:

1. Zeller, S. M. Morphological differencesbetween Nectria galligena Bres. and N. coccinea (ditissima). (Abstract) Phytopath. 12: 442. Sept. 1922.

Averna-Sacca, Rosario. O cancro (Nectria ditissima Tul.) da macieira e da pereira. Bol. Agr. Sao Paulo 22: 272-288. Sept./Oct. 1921.

Wiltshire, S. P. Canker control trials. Jour. Bath, West & South Co. Soc. V, 16: 269-272. 1922.

Powdery mildew caused by Podosphaera leucotricha (E.&E.) Salm.

Powdery mildew on apple was not so severe as usual in the Pacific Northwest. However, it appeared in greater abundance than normal in several of the eastern states.

More	Same	Less
Virginia	New York	Pennsylvania
West Virginia	Kentucky	Delaware
Tennessee	Idaho	Ohio
Arkansas	Oregon	Indiana
Illinois		Washington
		California

Virginia: Powdery mildew was more prevalent than I have seen it previously. The injury is slight as a rule, but it caused some uneasiness among the growers and some injury, especially when blossom buds were attacked. (Fromme).

Washington: Powdery mildew is almost entirely controlled this year. It has been very unfavorable for the fungus - hot, dry weather almost from the start, and then nearly everybody sprayed for it. A few orchards at higher elevations reported serious infection, but that is all. One man who uses an overhead sprinkling system

of irrigation has about the worst case. (Fisher).

Oregon: Not as bad as last year on the whole. Nevertheless very severe in some orchards, resulting in worse damage on susceptible varieties like Jonathan than scab this year. (Barss).

Delaware, New York, West Virginia: (See Pl. Dis. Bul. 6:15, 35. 1922)

Infection was most commonly observed to affect the growing shoots. In Virginia the disease was reported on leaves, blossoms, and young apples. Injury of young trees was commonly reported. In Kentucky some 2-3 year old trees of Rome Beauty were nearly defoliated (Magill).

Varieties that were affected were reported as follows by collaborators:

Jonathan:	Pennsylvania, Delaware, West Virginia, Oregon, New York
Rome Beauty:	Pennsylvania, Kentucky, New York.
Ben Davis:	Pennsylvania, Tennessee.
Stayman:	Pennsylvania, Delaware, West Virginia.
Grimes Golden:	Pennsylvania.
Yellow Transparent:	Delaware

The greater prevalence of the disease upon nursery stock and in young orchards is associated with neglect in spraying. Serious epidemics of the disease were reported as being checked by dry weather. Sulphur dust gave good control on young trees of Rome Beauty and Jonathan in New York (Chupp). Spraying with Bordeaux mixture was reported effective in Kentucky (Magill). In Oregon spraying alone, as for scab, is not sufficient for control in average seasons (Barss). Fisher[1] emphasizes the value of lime-sulphur in the pink stage along with careful pruning for thorough control in Washington.

References

Cited:

1. Fisher, D. F. Apple powdery mildew. Proc. Ann. Meet. Washington State Hort. Assoc. 15: 46-52. (1920)

Not cited:

Allen, W. J. Orchard experiments. Spraying trials at Glen Innes experiment farm. Agric. Gaz. New South Wales 33: 113-119. 1922.

Fisher, D. F. Lessons from the 1921 mildew epidemic. Proc. Wash. State Hort. Soc. 17 (1921) : 162-171. 1922.

Nordmann. Der apfelmehltau und seine bekämpfung. Deut. Obstolauz. 68: 202-203. June 1922.

APPLE - Crown gall

Crown gall caused by Bacterium tumefaciens EFS & Towns.

Crown gall, while not reported as on the increase, is considered very important in many states east of the Mississippi.

The hairy-root type of infection was commonly reported upon nursery stock. In some instances systemic infection was also reported. Several observations were reported of root rots following crown gall infection upon mature trees and thus causing serious loss with bearing trees. The following estimated percentages of loss were reported: Texas, 1.5%; Arkansas, 1%; Illinois, none; Arizona, less than 1%.

The following comments from collaborators show more definitely the situation in various states.

Massachusetts: Frequent on nursery stock. (Osmun).

New York: Found on Northern Spy and Dutchess. (Chupp).

Delaware: Hairy-root stage is found with young stock. Weakening of mature apple trees found prevalent in some sections. (Adams).

Tennessee: Early Harvest, Rome Beauty, Northern Spy, very susceptible. (Hesler).

South Carolina: Associated with Xylaria root rot. Reported to have caused a 1% loss in some nurseries. (Ludwig).

Mississippi: A very serious trouble on nursery stock in the state. (Neal).

Texas: A case of an apple tree affected with crown gall was noticed in which the galls were found to cover not only the roots, the trunk, and the limbs, but infection worked up and attacked even the terminal buds. Pseudomonas tumefaciens was present in all galls as proved by isolation work. (Taubenhaus).

Ohio: In most instances infection can be traced to introduced nursery stock which was infected. (Thomas).

Illinois: Chiefly on young trees and generally distributed throughout state. (Tehon).

Wisconsin: Twenty percent prevalence in one block of Wealthy in spite of mercuric-chloride sterilization. (Vaughan).

Iowa: Prevalent in nurseries: Estimated loss of 25%. (Melhus)

Arizona: Present in practically all of the apple districts of the state. The occurrence of large galls on trees recently planted points to imported nursery stock. Older trees die suddenly when the fruit is about half mature, especially where the water supply is not abundant. (Brown).

APPLE - Crown gall

The future in the control problem, from a knowledge of the survey reports, is directly concerned with nursery practices. It would appear that losses in future plantings could be reduced by improving nursery practices and strengthening the present nursery inspection service.

Melhus and Maney[1] in their study of control of crown gall on apple grafts in the nursery, state that "Fungicides which go into solution slowly, such as lead arsenate and Bordeaux mixture, have a much less injurious effect on the callousing process..... The use of Bordeaux mixture (8-8-50) with or without lead arsenate, reduced the percentage of crown gall about 66% over the checks, and nearly 50% over the mean percent of crown gall in all checks in the Wealthy variety."

Wormald and Grubb[2] report on experiments conducted at the East Malling Research Station, England with Paradise (layered) apple stocks as follows:

> "(1) Cutting the shoots with a knife gives rise to smaller galls than tearing them from the stool.
>
> "(2) Covering the cut surfaces at the base of the stocks with a protective layer, e.g., Stockholm tar or grafting wax, reduces the number and size of the basal galls.
>
> "(3) Galls on the stem above the base, and root-galls, may be largely prevented by careful handling and planting, so as to avoid unnecessary injuries."

Literature cited

1. Melhus, I. E. and T. J. Maney. A study of the control of crown gall on apple grafts in the nursery. Iowa Agr. Exp. Sta. Res. Bul. 69: 159-172. July 1921.
2. Wormald, H. and N. H. Grubb. Notes on the control of nursery stock against crown gall. Gard. Chron. III, 71: 198. April 22, 1922.

Sooty blotch and fly speck caused by Phyllachora pomigena (Schw.) Sacc. and Leptothyrium pomi (Mont. & Pr.) Sacc.

Similar climatic conditions are favorable to the prevalence of these two fungi which are generally reported together. In some instances sooty blotch is reported earlier than the fly speck. Sooty blotch is more conspicuous in its development and very pronounced upon light colored varieties of apples.

Prevalence compared with average year

More	Same	Less
Maine	Connecticut	Pennsylvania
Massachusetts	New Jersey	South Carolina
New Hampshire	Virginia	Indiana
New York	Kentucky	Wisconsin
Delaware	Ohio	
West Virginia	Illinois	
Missouri	Kansas	

APPLE - Sooty blotch and fly speck

The precipitation was above normal during August for Maine, New Hampshire, and New York. In Delaware the disease became established during July, for which month the rainfall was above normal. It is generally found that the disease becomes prevalent during protracted rainy periods and may be checked as suddenly as it appears with a period of dry weather. The diseases are usually reported during the period from July to harvest. According to Chupp, many orchards in Ulster County, New York, showed 20 to 75% infection with from 8 to 10% of the apples ruined, which means a loss of $10,000.

The following varieties of apples have been reported by collaborators as showing infection this year:

Connecticut: Gravenstein and Baldwin. (Clinton).

New York: Wolf River and Greening. (Chupp.)

New Jersey: Paragon, Stark, Greening, and Stayman. (Department of Plant Pathology).

Kentucky: Grimes, Mann, Delicious, Ben Davis, Winesap and Stayman. (Valleau).

Indiana: Winter Maiden Blush, Wealthy, Grimes, Jonathan, Indiana Favorite, York Imperial, and Maiden Blush. (Gardner)

The market inspection reports indicate that sooty blotch is more common than fly speck. In basket and barrel shipments 10 to 75% of sooty blotch and fly speck is often reported. The following observation made by F. R. Perry was the only instance of apparent development under storage conditions: "Shipped almost clean apples from Batavia, New York to Ithaca. On arrival when barrels were opened, the fruit was covered with sooty blotch that had evidently developed during shipment."

The usual apple spraying program will hold the disease in check. Increased prevalence was generally associated with failure to apply late sprays. Moist and shaded areas are associated with greater prevalence and the lower and innermost fruit is most commonly infected.

Root rots caused by various fungi.

Collaborators have submitted reports principally upon those rots associated with Xylaria sp. and Armillaria mellea (Fr.) Quelet. No apparent increase in prevalence over past years has been reported, but there appears to be a consistent loss of trees because of root rot pathogenes. In many instances the primary cause is difficult to determine.

Black root rot caused by Xylaria sp.

New York: Follows winter injury or other weakness. Always important. It is impossible to say what part the Xylaria sp. plays in the killing of the trees. Many trees die each year, on the roots of which are Xylaria. (Chupp).

APPLE - Root rots

South Carolina: Discovered for the first time in northwest corner of state. Killing several trees just coming into bearing. Complicated with crown gall but apparently the more important of the two. (Ludwig).

Illinois: In isolated spots in various northern sections. In one orchard causing serious injury to three year old trees. (Anderson).

In addition to the above states, West Virginia, Kentucky, and Arkansas also reported it.

Armillaria root rot caused by Armillaria mellea (Fr.) Quelet

Very few reports were submitted this year. Where no particular attempt is made to determine the prevalence, the nature of the disease is not such as to find many orchardists recognizing it in the various stages of development. Ohio, Wisconsin, Iowa, and Idaho reported the disease. In New York this fungus is found on the roots of many dying apple trees, but probably freezing or excess of water was the original cause. (Chupp).

Literature, not cited

Frank, Arthur. The mushroom root rot. Bi-Month. Bul. Wash. Agr. Exp. Sta. 9: 83-84. Jan. 1922.

Root rot caused by Hypholoma appendiculatum (Bul.) Karst.

Observed by A. L. Pierstorff growing on the roots of dying trees in an orchard in New York.

Root rot caused by Ozonium omnivorum Shear

Taubenhaus reports this trouble prevalent in the black lands of Texas and estimates a 3% loss for the state. Observed to be on the increase in Arizona where Brown estimates the loss in that state at close to 1%. (Pl. Dis. Bul. 6: 106,134. 1922)

Root rot (cause not determined).

Kentucky: Common with Winesap in low, wet land. In Boyd County this year an 8 year old orchard of Jonathan and Stayman had a 5% loss, mostly Jonathan trees. Land was cleared 10 years ago, very few stumps remaining. (Magill).

Indiana also reports an undetermined root rot.

Bitter pit (Stippen, Baldwin spot) - non-parasitic

Bitter pit was of more than normal prevalence, particularly in the states east of the Mississippi, and in certain sections serious loss was experienced. The prevalence compared with the average year was reported as follows:

APPLE - Bitter pit

More	Less	Same
New York	Arkansas	Massachusetts
Virginia	Colorado	Connecticut
Ohio		Delaware
Indiana		Idaho
Michigan		Washington

Estimated percentage loss was reported as follows: New York, 1-3%; Virginia, 3%; and Arkansas, trace.

New York: In Ulster County by far the worst disease attacking apples this year. Several counts indicate general injury of 75% of the Baldwin fruit. Half of this was unmarketable, resulting in a loss of approximately $70,000. (Chupp).

Virginia: Varied greatly in different orchards and more general in the southern valley. Especially prevalent where fruit was oversized. (Fromme)

Ohio: Fruit on light bearing trees show greatest injury. (Thomas)

The injury was reported this year on the following varieties: York Imperial, Grimes, Baldwin, Ben Davis, and Stayman.

Literature.

Adams, J. F. Some apple diseases not controlled by spraying. Trans. Penn. Hort. Soc. 35 (1921): 77-81. illus. 1922.
Herbert, D. A. Bitter pit in apples: the crushed cell theory. Phytopath. 12: 489-491. Oct. 1922 (Dec.) No. 10.

Water core (non-parasitic).

Reports have been submitted only from four states as follows: New York: Most common on Greening and early varieties of Red Astrachan, Wealthy, and Yellow Transparent. (Chupp). Delaware: Common with early apples, particularly Yellow Transparent. Apparently associated with several days of continuous rains just before harvest. (Adams). Indiana: Found on Northwestern Greening. (Gardner). Kansas: Reported on York Imperial. (Stokdyk).

Jonathan spot (non-parasitic)

Only seven states have reported Jonathan spot: New York: There is a great variation between different plantings. It appears much more frequently on the hill slopes than in the valleys. (Chupp). Ohio: Thought to be most marked on trees having slight crop.(Thomas). Illinois: Not at all serious this season in most localities. (Anderson and Tehon). Wisconsin, Colorado, Iowa, and Idaho were reported as having but slight prevalence.

Blue mold rot caused by Penicillium expansum (Lk.) emend. Thom.

Probably the most important rot from the standpoint of storage and transportation. Injury in the form of bruises, mechanical and insect injuries, usually paves the way for the fungus. Occasionally it follows infection by other fungi. An unusual amount of rot is reported from Illinois. In orchards with scale and fruit rot it seemed to have been much worse. Barnum[1] reports upon a stem-end infection by this fungus found in California on the Yellow Bellflower and Yellow Newtown. The fungus invades the fruit through the stem as proved by inoculation of stems of healthy apples with cultures of the fungus isolated from decayed fruit. The rot is retarded in cold storage although it makes some progress at a temperature of 45° F. and at room temperature the decay is rapid.

The Bureau of Agricultural Economics supplies the most extensive information upon the prevalence of this rot. Because of its general prevalence, the loss of fruit from this rot is, no doubt, underestimated.

Table 90. Losses from blue mold rot of apples, as shown by examination of cars at destination by inspectors of the Bureau of Agricultural Economics, 1922.

Origin of shipment	Percentage of decay		Origin of shipment	Percentage of decay	
	No. cars	Percent		No. cars	Percent
Arkansas	2	2-5	Pennsylvania	2	2
California	1	2	Tennessee	1	2
Colorado	3	1-15	Virginia	4	2-3
Idaho	3	13-20	Washington	5	25-35
	17	1-9		36	10-20
Illinois	1	30		331	1-9
	7	1-4			
Indiana	1	3	West Virginia	6	1-8
Maryland	2	2-3	Wisconsin	1	3
Michigan	3	2-12	Canada	3	1-3
Missouri	2	3	Unknown	5	10-27
Montana	1	1-5		16	1-7
New York	51	1-10			
Oregon	4	15-27	Total number cars		
	39	1-10	with blue mold rot	547	

Literature cited

1. Barnum, C. C. Stem end rot of apples. Science N.S. 55: 707-708. June 30, 1922.

Miscellaneous fruit rots and leaf spots

Pink rot caused by Cephalothecium roseum Cda. - This fungus, usually associated with scab infection, was reported as of less prevalence, in spite of the favorable season for apple scab. In New York a crop of Boiken apples, after being in storage ten days, was 30% spoiled by this disease. It was

said to be general in New Jersey, following scab infection. In Virginia infection was associated with scab as well as cedar rust on Pippins, while fruit was still on trees. (Schneiderhan). In Ohio it was reported very rare in spite of the wide-spread occurrence of scab on apples. (Selby).

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt. More of this disease was reported by collaborators. This may be associated with a greater production of early apples compared with last year. The disease was reported from the following states, principally upon early varieties of apples: Vermont, Massachusetts, Connecticut, New Jersey, Delaware, West Virginia, Ohio, Indiana, Illinois, Wisconsin, and Iowa. Red Astrachan was reported as severely affected in Massachusetts and Delaware, and one occurrence on unsprayed Esopus fruit in transit was recorded in Indiana.

Delaware: Very prevalent on Red Astrachan. Clusters of ripened fruit completely rotted upon trees. In one instance injury from rose chafer allowed for greater injury from rot.

Ripe rot caused by Phytophthora cactorum Schroet. What was thought to be this fungus was reported from Pennsylvania on growing fruit of the Ewalt variety.(Thurston). In this connection Lafferty and Pethybridge[1] describe a "rot occurring in apples in Ireland which was found to be caused by a species of Phytophthora which proved to be P. syringae Klebahn, and not P. cactorum Schroet., a species that has been recorded several times as the cause of a similar rot in apples and pears in other countries. The economic significance of the rot does not appear to be great. Supporting heavily laden, drooping branches with props and attention to orchard hygiene are suggested as preventive measures."

Dry rot caused by Alternaria sp. Associated with arsenical injury on fruit in Ohio (Thomas).

Spongy dry rot. From Massachusetts reported common in storage.(Osmun).

A list of fungi was submitted by Dana from Washington associated with apple rots, Dothichiza, Fusarium, Penicillium, Alternaria, Phoma or Phyllosticta, Rhizopus, Botrytis, and Cephalosporium.

Leaf spot caused by Cercospora mali E.& E. is again reported from Texas by Taubenhaus.

Reference

1. Lafferty, H. A. and G. H. Pettybridge. On a Phytophthora parasitic on apples which has both amphigynous and paragynous antheridia; and on allied species which show the same phenomenon. Sci. Proc. Royal Dublin Soc. 17: 29-43 Aug. 1922.

Miscellaneous bark cankers

Bark canker caused by Myxosporium corticolum Edgerton was reported from Connecticut by Clinton.

Apple canker caused by Fusicoccum pyrorum n. sp. is reported from New York by Chupp. Produces cankers on otherwise weakened trees. About 100 Duchess of Oldenburg apple nursery trees were killed by this disease . It also

caused cankers on Twenty Ounce that had been weakened by winter injury. (Chupp, C. and G. L. Clapp. Fusicoccum canker on apple. Phytopath. 13: 225-230. May, 1923.

Cytospora canker caused by Cytospora sp. Often associated with winter injury and reported from New York, Colorado, and Washington. This fungus has also been associated with species of the genus Valsa as the perfect state. (F. L. Stevens. An apple canker due to Cytospora. Illinois Bul. 217.)

Pox canker caused by Leptosphaeria coniothyrium (Fckl.) Sacc. (Coniothyrium fuckelii Sacc.) Reported for the first time from Ohio. Appears to be practically the same organism as that which causes blight in raspberries (Young).

Canker caused by Septobasidium retiformis ? According to Taubenhaus apple and pear trees in Texas are frequently destroyed by a superficial fungus, Septobasidium retiformis.

Heart rots caused by Polyporus sp. In neglected orchards and especially general and severe in Wyoming County, New York. (Chupp).

Heart rot caused by Fomes igniarius (L.) Gill. was reported from Connecticut by Clinton.

Miscellaneous non-parasitic diseases

Measles. Reported on Delicious from Kansas. From West Virginia, Sherwood writes, "This trouble is increasing and is apparently causing a considerable damage in certain sections in southeastern counties. Many samples have been sent to the office and I have observed the trouble frequently."

Canker. Reported by Taubenhaus from Texas as follows: "A new canker disease of apple and pear limbs has been met with in many orchards of east Texas. Repeated culture work did not produce any organisms whatsoever. The disease is characterized by deep cracking and dying of the bark and limbs and may be mistaken for the canker of fire blight. The trouble is believed to be due to some physiological nature not as yet clearly understood."

Sunburn canker was reported from Texas by Taubenhaus as follows: "Apple orchards, the trees of which are exposed to too much sunlight are frequently noticed to have the outer bark dead and badly cracked. This condition seems to be confined to the outer epidermis and does not penetrate or touch the cambium layer."

Sun scald. In Virginia sun scald was observed more prevalent, particularly upon York Imperial (Schneiderhan). In Delaware a hot burning wind on May 19 caused considerable injury in certain sections of Sussex County. Young tender foliage was badly burned on Yellow Transparent and fruit scald was observed upon Nero and Grimes Golden. (Adams).

Drought spot. Found in sections of Idaho where there was an insufficient amount of water and in the drier non-irrigated regions (Hungerford).

Drought injury due to hot dry weather in June, August, and September was a limiting factor in most sod orchards in Indiana, causing reduction in size, prematuring, and dropping of the fruit, and bitter pit in some varieties. Grimes Golden, Winesap, Ben Davis, and Jonathan in sod orchards were affected. (Gardner). It was also reported on Staymans in Virginia (Schneiderhan, Pl. Dis. Bul. 6: 133. Oct. 15, 1922).

Rosette. Reported from Delaware, Arizona, Idaho, and Washington . Not as prevalent and serious as last year.

Lenticel proliferation. Associated with excessive moisture in Ohio. (Thomas).

Growth cracks. Reported prevalent on July (Fourth of July) in Delaware and associated with excessive moisture. (Adams).

Wind injury. High sustained winds June 12, 13 caused foliage injury in Massachusetts, in many cases killing most of the foliage on one side of the tree. (Osmun).

Imperfect pollination. Owing to cold rains during blooming period H. H. Swain considers this as chief factor in a 40-75% reduction of a full crop in Indiana (Gardner). Adams in Delaware reports as follows: "Considerable of the so-called 'June Drop' was the result of failure in pollination. Weather conditions were too cold for activity of bees and many growers fully appreciated the loss of fruit because of this fact. Many apples were very irregular in form and on being cut open were found to be imperfectly fertilized. This condition was very common with the Yellow Transparent variety. Apples showing this irregular growth were also found to be more commonly russeted."

Winter injury

Clinton reports severe injury to fruit and shade trees by broken branches, prevalent in the northern part of Connecticut .

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Spray injury

Spray injury continues to be reported as one of the many important problems in the production of marketable fruit. If only one factor were always concerned, the problem would be easy to solve and our many inconsistent results would not exist. Spray injury is not always associated with any one consistent cause and as a result must be diagnosed carefully in each individual instance because of the numerous limiting factors. The injury takes various forms, such as russetting, fruit blemishes, burning of leaves, and dropping of fruit. The following account is based upon reports by collaborators and for the most part is concerned with spray injury caused by Bordeaux mixture or lead arsenate.

Copper injury is usually associated with excess moisture because of heavy rains following a protracted dry period. The following report is by J. W. Roberts of the Office of Fruit Disease Investigations.

"There was a moderate amount of spray injury, particularly Bordeaux injury, in the northwest Arkansas orchards. It was not, however, unusually

severe, although it must be remembered that in years when leaf spot is especially prevalent it is often impossible to tell the difference between Bordeaux injured leaves and leaves infected with Sphaeropsis. This is particularly true later in the season. In the vicinity of Maryland and Virginia there has been considerable spray injury due usually to over spraying. Most of the over spraying was due to the use of spray guns. The injury consisted of leaf spotting, leaf burning, and russet fruit and in extreme cases the leaves were so badly burned and the fruit pedicels so badly injured by the spray that there was a heavy defoliation and heavy dropping of fruit. The spray gun, unless very carefully used may cause a great deal of spray injury."

Delaware: Copper injury prevalent this season in the form of leaf spotting, russeting and spotting of fruit. Copper dust injury observed on Jonathan, Grimes, and Transparent. In addition to the varieties reported last year showing copper injury, the following were observed this season.(Adams).

Variety	Leaf	Fruit
Transparent	Severe	Slight
Red Astrachan	Severe	Severe
McIntosh	Severe	Slight
Stark	Slight	Slight
Nero	Slight	Slight

Ohio: Copper injury is reported more prevalent than last year.(Thomas).

Arsenical injury was reported from Delaware, Ohio, and Washington. In Delaware it was reported as a leaf spotting on Jonathan and Yellow Transparent. (Adams). Thomas, in Ohio, associated the injury with burning of leaves, blossom end injury and breakdown in fruit.

Fernald and Bourne[1] have recently reported their studies of injury to foliage by arsenical spray. The activities of climatic conditions appeared to be correlated with the injury.

"A special investigation was made on the effects of temperature, humidity, and light as affecting injury, and the authors found that with reliable arsenicals properly made, mixed, and applied, injury results from the combination of these factors. Neutral lead arsenate proved the safest of the materials used in clear weather, and in most cases it was even better than many of the others in cloudy weather. Clear weather spraying is said to be safer than cloudy weather and indications were observed that spraying at high temperatures can be done if the humidity is low, or at high humidities if the temperature is low." (Abstract. Exp. Sta. Rec. 47. Nov. 1922)

In Virginia spray injury to both fruit and foliage is common but is rarely of a severe type. Foliage burning has followed cold injury and scab in many cases (Fromme).

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Knight, H. H. Injuries to the fruit of the apple by agencies other than insects. New York (Cornell) Agr. Exp. Sta. Bul. 410: 491-496. pls. 8. 1922.

Dusting versus spraying apples.

Dusting versus spraying continues to be a project of experimentation and is of increasing interest and importance to orchardists. The following publications give data concerning the results of experiments conducted during 1921.

Britton, W. E., M. P. Zappe, and E. M. Stoddard. Experiments in dusting versus spraying on apples and peaches in Connecticut in 1921. Connecticut State Sta. Bul. 235: 207-236. 1922.

Dutton, W. C. and S. Johnston. Comparative dusting and spraying of apples and pears. Michigan Agr. Exp. Sta. Bul. 115: pp. 7-20. 1922

Quaintance, A. L. Dusting versus spraying of apples. Jour. Econ. Entomol. 14: 220-225. 1921.

Orchard disease surveys

Three reports have been submitted on results of surveys in the orchard sections of Virginia and Illinois. The information presented in these reports is sufficiently cordorsed to present strikingly the importance of orchard pests in certain localities.

The following table (Table 91) shows the apple disease situation in counties of the southern third of Illinois where most of the commercial crop is produced. While these field observations were not made wholly on commercial plantings, they are of interest as showing the degree of infection in that region. The presence of such infective material indicates partly the effectiveness of careful spraying and cultural practice, since as a rule the lesser percentages of infection have been found in commercial plantings; and it indicates as well the tremendous influence unsprayed and uncared-for plantings may have in preserving a disease and supplying a continuous possibility

for new infections. (Tehon).

Table 91. Field notations on five important apple diseases in Illinois - Showing degree of infection

County	Blotch	Fire Blight	Scab	Rust	Blister Canker
Marion	*, s	t,s	s,l	s	h
Clinton	t,l,l,tt	t	*,m		t,*,t
St. Clair		t,t	t		
Monroe	v		s	h	
Washington	t,t		t,t,t	t,s	
Jefferson	m,t,t,t,s,* m,*,t	t,t,*,*,	t,t,*,*,t	t,t,t,*,v	t,t,*,*
Wayne	s,m,v	*,*	s,*,l	l,h,*,v	v,m,m
Edwards	v,v,v,v	t,t,l	s,*,s,v		s,t,t,*
Wabash	v,s,h,v,t,v	l,s,t,m	v,l,h,v		m,m
White	v,s,v,v,v	l,t,t	m,t	*,t,t	*,m
Hamilton	m	t,*	*,*		*
Franklin	v,v,v,v,v,t m,h,m	t,t,m,h,t,l *,t	*,m,v	h,v,v,m,*,*,h t	m,t,h,v
Randolph	v	m	s	v	
Madison	m,h,v,v,v,v	m,m,m,m,m,h	v,m,v.v v	m,t,v	v,m,m
Williamson	v,t,m,v	t,t	v,t,v	v,t,l	m
Saline	v,v,v,v,v,v	h.l,l,l	m,h,m	v,l,t,t	m,m,m,*
Gallatin	v,v,v	v,m,m.m	*	*	
Hardin	t	m	m,m		t
Pope	v,t,v	t,l,m	h,m	m	
Johnson	t,t,v,v,v,v v,v,v	m,l,l,l,t	l,v,m,m,t	m,h,v,*,v	t,m,m,t,m,t
Union	v,v,v,v	t,m,l	m,m,m,m,s,s	m,s,s,s	t,m,h,t,m
Alexander	v,t	m,*	t	m	
Pulaski	v,v	l,l	t,v	t,t,t	
Massac	v,v,v	h,*,s	s,v,m	m,t	m,m

(*-occurrence: t-trace(to 2%): l-light (2-10%): m-moderate(10-25%): h-heavy (25-40%): s-severe (40-60%): v-very severe (60-100%))

Virginia apple disease survey data, 1922.

Table 92. Frederick County data by F. J. Schneiderhan from 32 orchards including 17 of York Imperial, 10 of Ben Davis, 2 of Stayman, 1 of N.W. Greening, 1 of Winesap, and 1 of Snedprose. The number of fruits counted in the different orchards ranged from 200 to 500. All data are for fruits.

Variety		Scab	Rust	Bitr Rot	Blo tch	Blk. rot	Cloud	Pitr pit	Spray burn
York Imperial	%inf. orchards	100	100	24	6	90	30	80	65
	max. %infection	56	9	2	4	10	54	25	5
	ave. %infection	20.7	4.4	0.2	0.2	2.1	5	4.6	1.1
Ben Davis	%inf. orchards	100	100	0	0	70	10	70	50
	max. %infection	70	9	0	0	11	15	8	11
	ave. %infection	35.8	3.2	0	0	4.4	1.5	2.7	2

Variety		Scab	Rust	Bitr rot	Blotch	Black rot	Cloud	Bitr pit	Spray burn
Stayman	% inf. orchards	100	50	0	0	100	50	100	50
	Max. % infection	86	0.5	0	0	2	37	2	0.5
	Ave. % infection	70	0.2	0	0	2	18	1.5	0.2
N. West Greening	% infection	60	1	0	100	13.3	1	0	0
Winesap	% infection	62	1.5	0	0	1.5	0	0	0
Sheep Nose	% infection	20.5	1.5	0	1.5	4	0.5	2	0
Summary All var.	% inf. orchards	100	97	12	10	91	30	72	53
	max. % infection	86	9	2	100	11	54	25	11
	ave. % infection	31	3.5	0.1	3.3	3.2	4.3	3.4	1.2

The importance of scab in this section will be seen by the fact that the percentage of fruit affected with scab (31) is greater than the combined total of all other causes of defects (19 per cent).

Fly speck was found in only one orchard on Winesap, the percentage of affected fruits being only 1.

Table 93. Bedford County data by R. H. Hurt. Data are from 43 orchards including 14 of Winesap, 9 of York Imperial, 7 of Yellow Newtown, 3 of Ben Davis, 3 of Black Twig, 3 of Cannon, and 1 each of Grimes, Stayman, Delicious, and Paradise Sweet. Data are fruits alone, 500 fruits being counted in each orchard.

Variety		Scab	Rust	Bitr rot	Blotch	Fly speck	Cloud	Bitter pit
York Imperial	% inf. orchards	22	89	67	44	33	11	100
	max. % infection	1	1.6	2	1	2	4	5
	ave. % infection	0.2	0.7	0.5	0.3	0.5	t	1.7
Winesap	% inf. orchards	100	7	93	0	71	57	86
	max. % infection	74	0.4	5	0	35	38	7
	ave. % infection	15	t	1.2	0	6.2	4.6	2.2
Yellow Newtown	% inf. orchards	100	71	100	86	43	14	100
	max. % infection	90	3	7	2	0.6	1	2
	ave. % infection	14.7	0.6	2	0.7	0.2	0.1	1.3
Ben Davis	% inf. orchards	33	67	33	100	0	33	100
	max. % infection	1	0.6	1	64	0	1	1
	ave. % infection	0.3	0.3	0.3	26.6	0	0.3	0.7
Black Twig	% inf. orchards	100	33	67	0	67	33	100
	max. % infection	88	0.2	3	0	90	0.6	3
	ave. % infection	31.8	t	1.7	0	30.3	0.2	1.9

Variety		Scab	Rust	Bitr rot	Blotch	Fly speck	Cloud	Bitr pit
Cannon	% inf. orchards	0	33	100	0	100	100	33
	max. % infection	0	0.2	1	0	2	1	0.2
	ave. % infection	0	t	0.8	0	0.9	0.8	t
Grimes	% infection	0	0	0	0	0.2	0	0.4
Stayman	% infection	0	0.4	0.4	0	0	0.2	2
Delicious	% infection	0	0.6	0	0	0	0	1
Paradise Sweet	% infection	2	0	1	25	0	0	2
Summary All var.	% inf. orchards	67	47	79	33	51	37	91
	max. % infection	90	3	7	64	90	33	7
	ave. % infection	9.6	0.3	1.1	2.6	4.3	1.6	1.6

Collated by F. D. Fromme

Additional references on apple diseases and their control.

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PEAR

Blight caused by Bacillus amylovorus (Burr.) Trev.

There was apparently a much greater prevalence of fire blight than reported the past two years. In California the disease incidence was reported to be greater than any previous year in the past ten (Nagle). In Canada the disease appeared more serious than during the past four or five years in the Province of Ontario (Howitt).

The initial injury has been reported as blossom blight followed with twig blight. In some sections late infections of twig blight only were observed.

The loss for the country as a whole was considerably more than reported during the past two years.

The following comments indicate the economic importance and prevalence in some states. (For other reports see Pl. Dis. Bul. 6: 32, 33, 119, 120, 121, 154. 1922).

Vermont: Pear blight unusually common everywhere. It seems to have spread largely this summer as the infection is only present in this year's growth. (Lutman).

Massachusetts: Apple more generally and severely affected than pear. (Osmun).

New York: The most important fruit disease in the state. In fruit and trees killed in Ulster and Orange Counties the loss is approximately $200,000. (Chupp).

Florida: This disease is the most common and the most destructive of the pear in this state. It is the cause of all the abandoned orchards. It is reported from every section where the pear is grown. (Burger).

Estimated percentage loss from fire blight for 1922 by states:

New Hampshire	Trace	South Carolina	50%	Illinois	5%
Vermont	3%	Kentucky	65%	Wisconsin	Trace
Connecticut	5%	Tennessee	Trace	Arizona	1%
New York	18%	Louisiana	40%	Idaho	2%
Delaware	3%	Arkansas	60%	Washington	Trace
Maryland	8%	Ohio	3%	California	15%
West Virginia	5%				

Reports are submitted indicating that fire blight in pear is directly concerned in the increased prevalence of fire blight in apple. In consulting Fig. 44 and Fig. 45 it is observed that fire blight of pear is slightly more extensive than reported for the disease on apple. While the same climatic conditions are conducive to the disease on both hosts, there is not sufficient evidence to warrant any correlation on the basis of the information submitted. Several comments on this question have been presented favoring both sides of the problem. For details see under apple.

Barss reports the presence of the disease on service berry and other pomaceous hosts in sections of the Williamette Valley, Oregon, but states that it is rare in orchards.

Varietal susceptibility was reported as follows:

New York: Percentage trees killed in Ulster County - Clapps Favorite 13%, Bosc 9%, and Bartlett 5%. (Chupp).

Georgia: Fire blight is most serious at this time. The Oriental strains, which are the most immune, are dying badly this year. On trees which have had the blighted limbs cut out this summer new infections started. We have several Chinese pears two to three years old, supposed to be immune to blight and so far none has shown up on them. (J. H. Miller).

Mississippi: Sand pears are only variety that is resistant. (Neal).

Indiana: Resistance of Kieffers observed July 26. (Gardner).

Michigan: (Southwest). The variety Kieffer is withstanding the disease in most cases, showing only a slight amount of twig blight, but more susceptible varieties such as the Clapp's Favorite are suffering infections even on the larger branches. (J. T. Bregger).

PEAR - Fire blight

Fig. 45. Prevalence of pear blight compared with the average year.

Control measures reported have been concerned with campaigns of eradication and securing resistant varieties and are essentially the same as the following recommendations made by M. F. Barrus.

> "Individual attempts to control fire blight of pears, apples and quinces are usually unsuccessful, beacuse of the ease with which the fire blight bacteria can be carried from place to place by insects. If an entire community where pears are grown would attempt to carry out the known control measures, the disease could be kept from doing serious damage. A considerable degree of control can be obtained in isolated orchards.
>
> "The methods to be employed are the removal of all holdover cankers during dormant season; patrol of orchard during the growing season to remove all blighted twigs, spurs, or suckers as soon as the disease is evident; disinfection of all cut surfaces and pruning tools used with a solution made by using one part corrosive sublimate and one part mercuric cyanide to 500 parts of water; maintenance of a spraying program that will keep insects under control." (M. F. Barrus. New York State Coll. Agr., Depts. Plant Path. and Entom. Weekly News Letter. May 8, 1922).

In addition to these methods Swingle[3] recommends that in Montana no more tillage or irrigation be given during the first part of the growing season than is absolutely necessary for the production of the crop, in order to prevent the formation of a large amount of succulent growth. The green aple aphis, which is

stated to be the most important carrier of blight infection after the bees stop working in the orchards, should be kept under control. The most important measure, however, is the use of resistant varieties. If the variety desired is susceptible, it should be topworked on a body and roots of one which is resistant and not likely to sprout.

According to J. P. Martin[1], the honey bee has been definitely proved to be a carrier of blight infection, but its value in the orchard as a pollenizing agent is so great that it would be unwise to try to control the disease by keeping it out, especially since other insects are also carriers. It is more practical to prevent contamination of the insects by destruction of holdover cankers during the winter months. The following quotation gives the results of control measures used in New York.

> "Groups of farmers are beginning to co-operate in eradication. They remove all old diseased trees and cankers in the winter, then twice a week in summer patrol the pear orchard, removing any twigs showing signs of the disease. This is fairly successful." (Chupp)

A new host, Prunus triloba var. plena, has been reported[2] for Bacillus amylovorus. The organism isolated was inoculated into other known susceptible hosts for comparison with other strains, with identical results.

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PEAR - Scab

Scab caused by Venturia pyrina Aderh.

In 1922 there were only five states reporting pear scab as more prevalent than the average year.

Table 94. Prevalence of pear scab compared with the average year.

More: Vermont, Connecticut, New York, Pennsylvania, Delaware, Michigan
Same: New Hampshire, Massachusetts, New Jersey, Maryland, West Virginia, Georgia, Ohio, Indiana, Illinois, Wisconsin
Less: Washington, Oregon

Estimated reductions in yield have been given as follows: Vermont, 5%; Connecticut, 1%; New York, 6%, Pennsylvania, 12%; Maryland, 1%; West Virginia, trace; Tennessee, trace; Ohio, 2%; Illinois, trace; Wisconsin, trace; and Washington, .5%.

Dates of first observation

Ohio ..... April 25
Indiana ..... May 23
Wisconsin ..... June
New York .....June 12
Illinois ..... July 19

Varietal susceptibility

Flemish Beauty ..... Connecticut, New York, Massachusetts
Clapps Favorite..... Connecticut
Seckel ..... New York

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PEAR - Leaf blight

Leaf blight caused by Fabraea maculata (Lév.) Atk.

Leaf blight was reported as more prevalent than during the average year in New Jersey, Delaware, Maryland, and Illinois. In Maryland and Delaware the increase in prevalence is to be associated with neglect of spraying because of frost injury. There was said to be less leaf blight than usual in Connecticut, New York, West Virginia, Ohio, and Indiana. The estimated percentage loss by states was reported as follows: Connecticut, 1%; Delaware, 5%; Maryland, 5%; West Virginia, Illinois, Kentucky, and Tennessee, a trace. In Delaware the disease has been the most serious disease of pear the past two years. Because of frost injury, spraying has not been generally practiced. Infected leaves collected March 25 showed mature ascospores 5 days later under laboratory conditions. Leaf infection in the field was first observed June 26 and fruit infection August 9.

In Delaware good control was secured with early applications of Bordeaux mixture up to July. Where the second codling moth or July spray was omitted the disease became prevalent because of the heavy rains throughout July. Complete defoliation occurred by the end of July in neglected orchards (Adams). The following results of experimental spraying were reported from New Jersey by the Department of Plant Pathology.

Spray schedule: (1) Dormancy; (2) Cluster-bud, April 6; (3) Petal fall, April 25; (4) Seven days after petal fall, May 2; (5) May 11; (6) June 6, (7) August 10.

Treatments:

Block 1. Commercial lime sulfur as per schedule.
" 2. Self-boiled lime sulfur as per schedule.
" 3. Self-boiled. Omit 4.
" 4. Commercial lime sulfur. Omit 4.
" 5. Commercial lime sulfur. Omit 4 and 5.
" 6. Commercial lime sulfur, as per schedule.
" 7. Commercial lime sulfur. Omit 4, 5, and 6.

Table 95. Results of pear spraying and effect of spray treatment on the fruit in New Jersey (Dept. Plant Pathology).

	Results of pear spraying		
	Clean (percent)	Diseased (percent)	Russeted (percent)
Check	4.5	95.5	4.6
Block 1	90.9	8.1	76.2
" 2	59.5	40.5	9.0
" 3.	32.6	67.4	8.1
" 4	71.7	28.3	13.8
" 5	56.1	43.9	10.2
" 6	88.0	12.0	47.5
" 7	78.8	21.0	55.5

PEAR - Leaf spot

Leaf spot caused by Mycosphaerella sentina (Fr.) Schröt.
(Septoria pyricola Desm.)

Leaf spot was reported from New York, Delaware, Florida, Ohio, Illinois, Michigan, and Kansas. In New York the Bosc, Seckels, and Bartlett varieties were susceptible in the order named, while only an occasional infection was found upon Kieffers, according to Chupp.

Miscellaneous diseases (parasitic)

Sooty blotch caused by Phyllachora pomigena (Schw.) Sacc. Observed in Ulster County, New York as rendering pears unsalable in several orchards. This was the worst disease affecting fruit of pear in Ulster County this year. (E. V. Shear). In Delaware the prolonged wet periods in July with neglected orchards favored prevalence. (Adams).

European canker caused by Nectria galligena Bres. Present throughout western Oregon. Occasionally bad in certain varieties. Susceptibility as far as determined runs in the following order for the varieties observed: D'Anjou, Bosc, Howell, Surprise, and Bartlett. (Barss).

Powdery mildew probably caused by Podosphaera leucotricha (E. & E.) Salm. Present in Hood River Valley and western Oregon generally. In Hood River County reported as quite abundant particularly on fruit of D'Anjou where proper sprays have not been applied. Some varieties like Bartlett are practically unaffected. (Barss).

Twig blight caused by Monilia sp. Rather severe in California on variety Madeline (early unimportant variety); also found on Bartlett but rare. (Horne).

Root rot caused by Ozonium omnivorum Shear. Very prevalent in Texas, estimated reduction in yield 10%. (Taubenhaus).

Heart rot, cause undetermined. Present in trees that have been injured slightly in nearly all orchards. (Chupp).

Canker caused by Septobasidium retiformis, reported from Texas - see apple.

Black rot caused by Physalospora cydoniae Arnaud. Reported as a fruit rot from Indiana and Illinois.

Crown gall caused by Bacterium tumefaciens EFS & Towns. Reported from Washington. (Dana).

Corticium stevensii has been under observation at Satsuma, Florida for several years on a few pear trees. Damage negligible. (J. R. Winston).

Miscellaneous diseases (non-parasitic)

Foliage scalding - Washington; alarmingly severe in many cases, affecting Bartlett most severely, and Kieffer and D'Anjou in same situation not at all. (Dana, Pl. Dis. Bul. 6: 122. Oct. 1, 1922).

Bitter pit - Reported from Oregon and Washington.

Black end - Probably drouth trouble. Reported from Washington and Oregon. (Barss, Pl. Dis. Bul. 6: 142. Nov. 1, 1922.

Black leaf or soursap , probably a seasonal injury - Reported from California. Severe generally in shallow soils with dense subsoils, especially where very dry, last year. Heavy losses of young trees in dead and much injured trees. (Horne).

Physiological canker - Same as described for apple in Texas. (Taubenhaus).

PEAR - Miscellaneous

Blossom blight (uncertain). Drouth injury and swollen tips are reported only from Washington by Dana.

Spray injury.

Oregon: Lime sulfur russet slight this year even on susceptible varieties like Bosc and Comice. In Josephine County injury was noticeable where spraying was done on hot days. (Barss).

Recent literature

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Kazui, Masatoshi. Nashi byôgaichû kufo yobo reki (Spray calendar for control of disease and insect injuries of sand-pear), Byôchu-gai Zasshi (Jour. Plant Prot.) 9: 34-38. Jan. 1922.

Frost injury

In some sections frost injury was more severe upon the pear than apple.

Vermont: Percent of crop injured, 1.5. (Lutman).

New York: Fruit was badly russeted and cracked. (Chupp).

Delaware: An estimated reduction of 70% in the crop as the result of frost injury. (Adams).

Ohio: Very serious in some sections. (Thomas).

QUINCE

Fire blight caused by Bacillus amylovorus (Burr.) Trev.

The same prevalence compared with the average year was reported for Connecticut, Pennsylvania, West Virginia, Virginia, Texas, and Illinois. In New York it is considered the most important disease of the host and in Ulster County about 25% of the trees were killed.(Chupp). It was reported troublesome locally on quince in Pennsylvania. (McCubbin). In West Virginia and Delaware it was reported important but the host is not grown commercially to any extent. The estimated reduction in yield for New York was 6% (Chupp) and for Texas 1% (Taubenhaus).

Leaf blight caused by Fabraea maculata (Lev.) Atk.

No increased prevalence was observed for this disease during the year. Reports of its occurrence were submitted from Massachusetts, Connecticut, Delaware, Virginia, South Carolina, Ohio, Indiana, and Illinois. Leaf infection causing serious weakening through premature defoliation was most generally reported. Only infection on fruit in the market was reported from Virginia and Indiana. An estimate of 8% reduction in yield was reported for New York (Chupp) and 1% for Delaware (Adams).

QUINCE - Rust, Miscellaneous diseases

Rust caused by Gymnosporangium germinale (Schw.) Kern (G. clavipes Cke. & Pk.)

Reported from New Hampshire, Massachusetts, Connecticut, New York, Delaware, Pennsylvania, and Ohio. Fruit infection only was reported in 1922, although in some seasons serious infection of the growing shoots occur. In Ulster County, New York severe infection was found in one orchard. Twenty-five percent of the fruit destroyed. (Chupp). Increased prevalence was reported in Pennsylvania. Several reports of severe infection were received from Dauphin, Cumberland, Southampton, and Adams Counties. (Thurston). In Northampton County the infestation immediately surrounding Wind Gap apparently runs from 70 to 90% infection. (Broadbent).

Miscellaneous diseases

Black rot caused by Physolospora cydoniae Arnaud was reported from Massachusetts, Connecticut and Ohio.

Fruit spot caused by Phoma pomi Passer. was reported from Connecticut and Indiana.

Powdery mildew caused by Podosphaera oxyacanthae (DC.) De Bary. First report of disease in Illinois: "Our accession number 6023 contains leaves of quince affected by a powdery mildew, which we take to be Podosphaera oxyacanthae. This collection is especially interesting since it is the first record of the disease on this host in Illinois and also because of the fact that all of the leaves on the four trees examined showed a very uniform and heavy coat of mildew with an abundance of mature ascocarps. The collection is from Vermillion in Edgar County on August 30, 1922." (Tehon).

DISEASES OF STONE FRUITS

PEACH

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt.

Brown rot of peach, as usual, was most destructive in the commercial plantations in the East and particularly in the Atlantic States. The only states reporting an increase in prevalence compared with the average year were Massachusetts, West Virginia, Kentucky, and Arkansas, while Maryland and Illinois reported less. Since the crop was not reduced by frost injury to the same extent as last year, it is natural to expect that the losses in bushels would be much greater because of the increased production. The losses in the states reporting were much greater than last year, except in Tennessee, Georgia, Louisiana, Texas, and Washington.

PEACH - Brown rot

Economic importance

Reports generally state that the greatest loss in fruit rot occurred in orchards where spraying or dusting was neglected or not thoroughly conducted. Thus, while brown rot on the fruit was very serious in unsprayed plantings in Georgia, in commercial orchards it was well controlled, according to McHatton, who states also that "The control of the curculio has improved and the brown rot is not so prevalent" (July 1). J. W. Roberts reported that in the Fort Valley district spraying was general and "the fruit was more free from rot than it has been for several years" (July 7). In this section there was considerable brown rot in some of the early varieties at harvest time, according to John C. Dunegan, but little on the later varieties in most orchards. Delaware reports the disease as of "minor importance in sprayed orchards." In Maryland, according to Jehle, brown rot was "severe on all unsprayed fruit," but on "sprayed trees was well controlled." Giddings reported that in West Virginia, "General lack of spraying on peaches results in heavy loss." In Mississippi, according to Neal, the usual spraying schedule holds the disease in check, but where it had not been followed brown rot was severe. In Arkansas the disease was said to be very severe in unsprayed orchards. In Ohio there was considerable rot in unsprayed orchards, but it was well controlled where properly sprayed, according to Thomas. Indiana reported it as "serious only in unsprayed orchards and on fruit affected with sunscald." Stokdyk stated that in Kansas no loss occurred where trees were properly sprayed. Although blossom blight and twig blight were unusually severe in Illinois there was not much damage from fruit rot, according to Anderson, due partly to the dry summer, and partly to efficient control of the curculio. In Oregon the disease occurred in the western part, but was rare or absent east of the Cascades, according to Barss. In Kentucky it was said to be "the most troublesome disease of the peach, especially in farm orchards where they do not have the spray equipment." In South Carolina blossom blight early in the season was followed by cankered and blighted twigs and fruit rot, although there was perhaps somewhat less than usual of the last due to dry weather, according to Ludwig. The disease was reported as causing considerable damage in some parts of Florida, according to Burger, but the loss as a whole was slight.

Dates of first appearance

April	(blossom blight)	Illinois	Collinsville, Madison County
June 26	(fruit rot)	"	Hoodville, Hamilton County
April 10	(blossom blight)	So. Carolina	Clemson College
May 11	(fruit rot)	" "	" "
April 24		Georgia	
May 10		New York	Nassau County
May 19		Indiana	Franklin County
June		Mississippi	Columbus
June		Arkansas	Fayetteville
June 1		Virginia	Jonesville
June 5		Kentucky	
June 7		Delaware	Bridgeville
June 7		Pennsylvania	
June 21		Ohio	Washington County
July 11		Kansas	Montgomery County
July 14		Connecticut	Wallingford

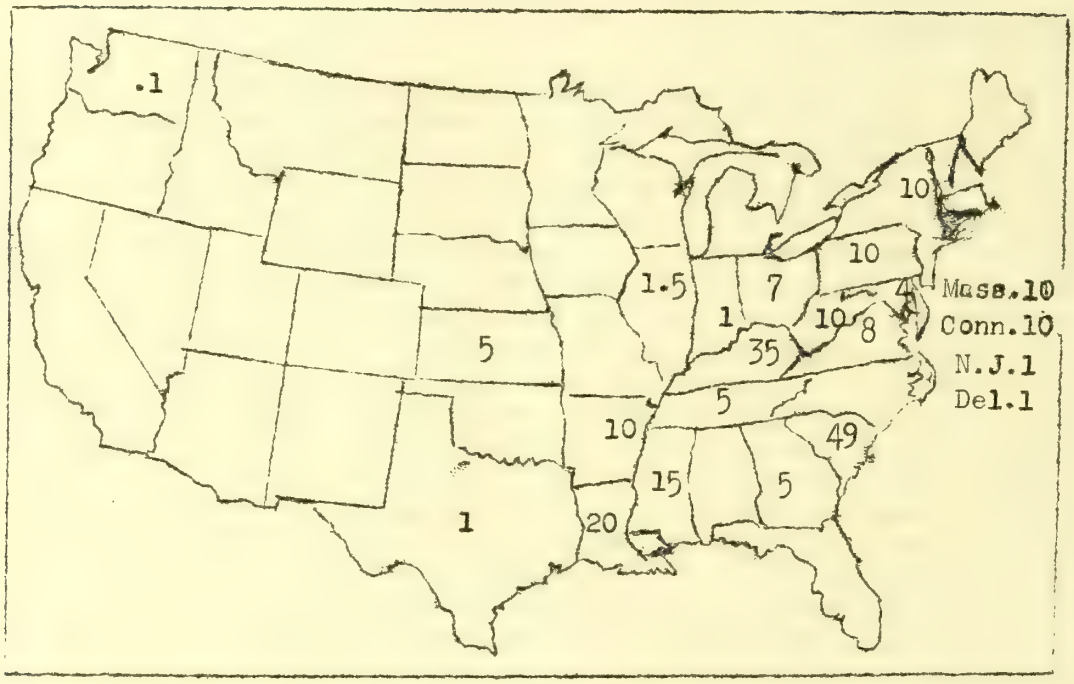

Fig. 46. Estimated percentage loss from brown rot in 1922.

Mature apothecia were reported February 28 in Georgia and April 12 in Delaware. According to the results of studies made by W. N. Ezekiel[2], "Under natural conditions apothecia may develop in the spring following inoculation," and cold is probably a factor influencing their production, which may be inhibited, even if development has already begun, by burying the mummies below the surface of the soil.

Weather relations

Favorable temperature with rainy periods were conducive to the greater prevalence of blossom blight in the southern peach belt. McClintock[3] stated (August) that in Georgia the excessive rains were "especially conducive to the development of brown rot, starting first with the blossoms, and continuing on the fruit in both the green and mature stages." Dunegan, however, reported that the lack of rain "was very favorable to the successful harvesting of such varieties as Hiley and Elberta, "in the Fort Valley district. Gardner said that the high temperatures in Indiana were favorable to the disease. In Illinois Tehon accounts for serious blossom blight by citing the moist spring weather, while fruit rot, on the other hand, was held in check by the dry hot summer. A wet July in Maryland, Delaware, and New Jersey was very favorable for the fruit rot. In Marion County, Oregon, the disease "started up after a few August rains but was checked immediately by warm dry days which held through most of the picking season," according to Barss.

The following report by Dunegan refers to the Fort Valley district of Georgia:

> "Blossom blight was most prevalent during the period from March 26 to 30, a period of comparatively high temperature and humidity. A drop in temperature and decrease in humidity on March

31 apparently stopped the rapid spread of the fungus and prevented the damage from reaching serious proportions. On April 19, following a heavy rain storm, old blighted Carman blossoms were observed to be covered with fresh spore tufts. During rainy weather there was pronounced gumming at the base of blighted blossoms."

Varietal susceptibility

Connecticut: Worst on early varieties. (Clinton).

New Jersey: Particularly bad on Carman and Champion. (Department of Plant Pathology).

Pennsylvania: Bad on Elberta, which is usually fairly resistant, in Adams County. (Walton).

Delaware: Belle of Georgia and Hale varieties appeared very susceptible in some sections. (Adams).

Kentucky: Red Bird variety especially susceptible and unless sprayed will seldom mature a crop. (Magill).

Tennessee: Hale susceptible. Elbertas and Bracket resistant. (Hesler).

Georgia: Blossom blight was noted in varying degrees of severity upon the following varieties: Red Bird, Carman, Uneida, Georgia Belle, Early Rose, Yellow Hiley, and Elberta. (Dunegan).

Kansas: Early varieties most susceptible. Amsden variety very susceptible. (Stokdyk).

Control of brown rot

It has already been mentioned that in nearly all cases the disease was reported as important only in unsprayed or improperly sprayed orchards. The effect of the control of curculio on that of brown rot was noted in Georgia and Illinois. In the following quotations are given some of the methods used or recommended in various states:

New York: Blossom blight is the type of injury that should be avoided by a timely application of the proper fungicides. It would seem advisable, therefore, that the pre-blossom spray (or dust) be applied this season. Lime-sulphur 1 to 50, or 80 to 10 sulphur arsenate dust is recommended for peaches when the blossoms show pink. (New York State College of Agr. Weekly News Letter, April 17, 1922).

Delaware: Sulphur dust and self-boiled lime sulphur have given equally good control this season. (Adams).

Maryland: On sprayed (self-boiled and atomic sulphur) trees the disease was well controlled. A few are dusting. (Jehle).

Ohio: In orchards sprayed with self-boiled lime sulphur or with lime sulphur glue, the rot is held in good control. The importance of a spray two to three weeks before harvesting is very apparent, and this is the first year that such practice is being generally followed in certain peach districts of the state. (Thomas).

The following results were secured by Snapp(4):

"Data from two years' work in Mississippi and one year's work in Georgia show the liquid spray to be somewhat superior to the dust for the control of the curculio under heavy infestations, but for brown rot and scab control the two methods of pest control gave about equal results. The 80-5-15 dust formula gave practically as effective control of curculio, brown rot, and scab yearly as the 80-10-10 or other dust formulas containing more arsenate of lead. An application of arsenate of lead when seventy-five percent of the petals were off and another four weeks before the fruit is due to ripen in addition to the treatments when the calyces were shedding and again in two weeks is strongly advised, especially in latitudes where two generations of the curculio occur."

Dutton and Johnston(2) in Michigan have published results on the control of brown rot on peaches and plums:

"A report is given of experiments carried on for the control of brown rot of peaches and plums in which lime-sulphur solution and sulphur dust were compared. The results of the experiments were considered satisfactory, and fruit from dusted trees held for several days after harvest showed much less rot than fruit from check trees. In 1921 the experiments consisted of the use of sulphur dusted on the trees, and while there was but little brown rot on certain varieties of peaches the development of rot subsequent to harvest was less on the fruit that had been treated." (Abstract from Exp. Sta. Rec. 47. Oct. 1922).

Recent literature

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3. McClintock, J. A. Peach tree cankers. Amer. Fruit Growers Mag. 42[8]: 12. Aug. 1922.
4. Snapp, Oliver I. Dusting vs. spraying for the control of the curculio, brown rot, and scab of peaches. (Abstract) Phytopath. 12: 250-252. May 1922.

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PEACH - Brown rot, Leaf curl

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Laidlaw, W. Brown rot on stone fruits. Jour. Dept. Agr. Victoria 20: 442-443. July 1922.

Snapp, O. I., W. F. Turner, and J. W. Roberts. Controlling the curculio, brown rot, and scab in the peach belt of Georgia. U. S. Dept. Agr., Dept. Circ. 216. 30 p. May 1922.

Leaf curl caused by Exoascus deformans (Berk.) Fckl.

The commercial peach belt in the East includes thirty-four states of which twenty have reported the presence of leaf curl during 1922. The disease was generally reported as more prevalent than last year, but somewhat less than during the epidemic in 1920.

The following list indicates the prevalence of leaf curl as compared with the average year, as reported by collaborators:

More: Ohio, Tennessee, Michigan, Illinois, Arkansas, Missouri, Oklahoma, Washington
Same: Massachusetts, New York, Pennsylvania, Georgia, Mississippi, Kentucky, Indiana, Oregon, California
Less: Connecticut

Connecticut: Inconspicuous, considerably less than usual. (Clinton).

New York: Reports from Orleans, Wayne, Columbia, Orange, Ulster, Seneca, and Chautauqua Counties show increased prevalence, particularly in poorly sprayed or unsprayed orchards.

Pennsylvania: Reports more numerous than last year, but is generally considered as not very serious. (Thurston).

PEACH - Leaf curl

Delaware: Prevalent in neglected orchards or when dormant spray was applied too late. (Adams).

Maryland: Leaf curl bad in places where they did not spray or did not apply spray properly. (Jehle).

Kentucky: Prevalent all over state - about as usual. (Valleau).

Tennessee: Observed early in April; very abundant this year. Most cases of spraying done too late. (Hesler).

South Carolina: Present. Loss apparently not very great. (Ludwig).

Georgia: Generally distributed as usual. Serious in some orchards where late, cold snaps were experienced. Had little effect upon the general crop. (McHatton).

Mississippi: Not nearly so common this season as last. Damage very slight at the experimental orchard. (Neal).

Ohio: Leaf curl has been uncommonly severe on susceptible varieties over the whole of Ohio. In the lake shore region serious defoliation has been reported where delayed dormant or any late application of lime sulphur for scale control has been relied upon. The losses promise to be quite serious and may serve to fix standards in time of application. (Selby).

Effects of defoliation due to leaf curl are still in evidence in many orchards in Ottawa County. In such orchards the crop is a complete loss and there can be little hope for many of the trees surviving the winter. (Thomas, September 1).

Illinois: Peach leaf curl is very severe on unsprayed orchards. One orchard at Lilly, which was sprayed in March showed a very heavy infestation of leaf curl. We received some specimens the other day of the leaf curl on fruit about a half an inch in diameter. (Amderson, June 12).

Michigan: Due to wet spring, spraying commonly neglected or put on late. Curl is common. Defoliated trees seen everywhere in fruit section. Correspondence on this disease has been unusually heavy from all parts of the state. Would estimate loss as more than average, perhaps reducing crop value 5-10% in the non-commercial orchards, and by first figure in commercial orchards, where better care of trees has allowed leaf replacement to go on more rapidly. Crop prospects at present good. (Coons, July 1).

Missouri: This has been a very bad season for peach leaf curl, no doubt because of the cold, wet spring. In some cases the leaf curl appears everywhere the trees have been sprayed. (Hopkins, July 5).

Kansas: Unusually severe in southeastern Kansas. In unsprayed orchards will cause loss of 35% or more. Sprayed orchards fairly well controlled. General throughout state. (Stokdyk, July 1).

PEACH - Leaf curl

Washington: Prevalent and doing considerable damage in commercial orchards in the Snake River section of eastern Washington. Very prevalent in home orchards in western Washington although no accurate estimate of losses can be made. (Dana).

Oregon: General over the state. Apparently less severe than last year. (Barss).

California: General, but damage apparently not great in cases observed. On the increase. (W. S. Fields).

Table 96. Showing estimated percentage loss from peach leaf curl as reported by collaborators in 1922.

State	Percentage loss	State	Percentage loss
Massachusetts	2	Ohio	5
Connecticut	1	Indiana	.5
New York	6	Illinois	2
Pennsylvania	2	Michigan	2
Maryland	1.5	Iowa	2
West Virginia	t	Missouri	o
Kentucky	6	Kansas	10
South Carolina	t	Idaho	t
Georgia	.5	Washington	.5
Arkansas	2	Oregon	3

Dates of earliest appearance of disease observed by collaborators

April ..... Fayetteville, Ark.	April 28.... Strausburg, Mo.
April 4..... Clemson College, S. C.	May 3..... Lyons, Kansas
April 10.... Illinois	May 10..... Dover, Delaware
April 22.... Stillwater, Okla.	May 14..... Agricultural College, Miss.
April 25.... Rocky Mount, W. Va.	May 16..... Allen County, Ohio
April 27.... Knox County, Ind.	May 29..... Tioga County, N. Y.

Control

The greater prevalence in the majority of instances is associated with poorly timed applications of the dormant spray. In some instances inclement weather interfered with spraying, while many growers entirely neglected to spray.

Delaware: Thoroughly controlled with dormant spray. (Adams).

Arkansas: Dormant spray effective. (Elliott).

Ohio: Delayed applications of fungicide resulted in very severe losses in Port Clinton district. (Thomas).

Idaho: San Jose scale spray controls it. (Hungerford).

PEACH - Leaf curl

Oregon: Perfect control with Bordeaux applied in time. Much spraying done from December to middle of February with excellent results. More concerted spray campaign last winter than usual. Results splendid. (Barss).

Washington: Dana[1] in a recent bulletin states that Bordeaux mixture 3-3-50 formula has given good results in some localities, but the 4-5-50 or 5-5-50 strength is more generally recommended. In a few localities even better protection has been obtained with a still stronger spray (6-6-50 or even 8-8-50). Lime-sulfur gives satisfactory control and has some advantage because of its value in the control of San Jose scale.

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Dutton, W. C. and S. Johnston. Dry lime sulphurs and similar materials for controlling apple scab and peach leaf curl. Michigan Sta. Spec. Bul. 115: 51-54, 1922.

Scab caused by Cladosporium carpophilum Thüm.

Scab was reported principally in the states east of the Mississippi or within the limits of commercial peach production. It was in general about as prevalent as usual, except in the following states which reported an increased prevalence, Massachusetts, New Jersey, Virginia, Mississippi, Arkansas, and Kansas. The short crop last year and general neglected spraying do not appear to be correlated with the prevalence this year. Rainy weather during the ripening period was most concerned in the prevalence of scab upon the fruit. In Maryland, scab was unusually severe in unsprayed orchards, causing fruit to crack and making conditions favorable for rot. Even in sprayed orchards much scab developed. (Temple and Jehle). In Virginia the unusual prevalence was associated with failure to spray early enough (Fromme) Around Bowling Green in Kentucky this season peach trees not sprayed were infected with scab to such an extent that the fruit brought $1.75 per bushel while fruit from scab brought $2.75. Similar results were observed around Louisville. (Magill). Generally distributed in Georgia and in commercial orchards 5-10% infection, while in uncared for plantings from 80-100% infection. (McHatton). Neal reports it present on twigs and leaves of nursery stock in Mississippi. Much more severe than usual and on all unsprayed fruit in Arkansas. (Elliott). Very prevalent throughout Ohio and the leaf spot disease associated with a Cladosporium, thought to be the same organism, has caused serious defoliation in many orchards. (Thomas). Infected nursery stock

was observed being used in Jefferson County, Indiana. (Gardner). Illinois reports show the disease is not serious from a commercial standpoint but quite prevalent this season - more than I have ever seen before, usually in unsprayed orchards. (Anderson). Present generally in unsprayed orchards in Kansas. Seedling peaches badly affected, causing 50% of them to be worthless. (Stokdyk).

The infection this year was most commonly reported on the fruit. The most serious infections were found in the farm orchards or orchards where spraying had been neglected. The estimated percentage loss this year by collaborators is given in Table 97.

Table 97. Estimated percentage loss from peach scab in 1922.

State	Percent loss	State	Percent loss
Massachusetts	t		
Connecticut	2	Tennessee	1
New York	1-2	Georgia	3
Delaware	3	Mississippi	1.5
Maryland	2	Louisiana	2
Virginia	3	Texas	1
West Virginia	t	Arkansas	3
Pennsylvania	2	Ohio	3
Kentucky	30	Illinois	t
		Kansas	5

Dates of earliest recorded appearance, 1922.

April 12 .... Perry County, Indiana
May ..... Van Buren, Arkansas
June 21..... Bridgeville, Delaware
July ..... Newton, Mississippi
July 19..... Hamilton County, Ohio
August 14... Yatesville, Connecticut

The early varieties were observed commonly affected. In Ulster County, New York during July and August considerable was found on Elberta peaches. Carman and Champion varieties were noticeably less affected. In Nassau County scab on Early Crwafords was practically uncontrolled. (Chupp). Fruit infection was especially severe on Belle of Georgia in Arkansas. (Elliott).

Control of peach scab

New Jersey: Good control of scab with sulfur dust, 80-10-10

Delaware: Dusted and sprayed orchards showed equally good control. Infection most prevalent at stem end. (Adams).

Georgia: Controlled in commercial orchards by spray. (McHatton).

Ohio: Easily controlled by sprays in general use; severe only where thorough spraying is not done.

Kansas: Sprayed orchards fairly well controlled. (Stokdyk).

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Snapp, Oliver I., William F. Turner, and John W. Roberts. Controlling the curculio, brown rot, and scab in the peach belt of Georgia. U. S. Dept. Agr. Circ. 216: 1-30. May 1922.

Stanford, H. R. Control of peach scab. Month. Bull. Dept. Agr., California 11: 765-774. Oct. 1922.

Disease noted as increasing in occurrence in peach-growing districts of southern California in past two or more years; same complaint has come from other parts of state.

Bacterial spot caused by Bacterium pruni EFS.

There was no general increase of bacterial spot for the commercial peach-growing section in the East, but in several states it was of serious economic importance and is constantly on the increase. It should be mentioned that it is often very difficult to tell bacterial spot from spray injury and sometimes it is impossible when only a few leaves are submitted late in the season. The distribution of the disease is indicated in the following list showing the prevalence compared with the average year.

More:	Connecticut, Delaware, Kentucky, South Carolina, Mississippi Indiana
Same:	New York, New Jersey, Maryland, Virginia, Louisiana, Texas, Arkansas, Illinois, Kansas
Less:	Georgia, Ohio, Missouri, Arizona.

Delaware: The most prevalent and important disease in peach production. Leaf and twig infection were the most important symptoms and 50-75% defoliation was common in many orchards. This year's observations indicated that most severe infection occurred with trees growing in light sandy soils. (Adams).

Indiana: We are inclined to believe that most of the canker trouble is due to Bacterium pruni, followed by other organisms. There is also quite an abundance of scab in the canker stage, but ordinarily there is no difficulty in identifying the scab cankers; but after the first season it is not at all easy to identify Bacterium pruni cankers. We are coming to feel in Indiana that Bacterium pruni is by far the most serious peach disease with which we have to deal, because of its defoliating effect upon the tree and because of the extreme difficulty in controlling it. Brown rot and leaf curl can be controlled, but Bacterium pruni is a real problem. (Gardner).

Other states: Pl. Dis. Bul. 6: 36, 98, 107. 1922. Collaborators have submitted the following estimates of reduction in yield for 1922:

New York	1.5%	Texas	1%
Delaware	5%	Arkansas	1%
Maryland	None	Indiana	3%
South Carolina	2%	Illinois	2%

The first appearance of the disease was reported as follows by the collaborators:

Louisiana	March	Delaware	May 24
Indiana	April 27	Illinois	June 10
Arkansas	May	Virginia	June 15
Mississippi	May 10	Connecticut ...	June 20
South Carolina	May 11	Ohio	July 12
Missouri	May 19	New York	July 20

Varietal susceptibility is reported principally for the Hale and Elberta. Burkholder reports the Champion as resistant in Indiana, while in New York Chupp reports it worst on Champion and Belle of Georgia in Ulster County.

Illinois: In our variety orchard at Urbana, representing about 50 varieties, the Hale and Elberta were the only ones showing any appreciable loss from shot hole and few other varieties were infected. Hale seems to be more susceptible than Elberta in most orchards. At the University farm the percent of fruit infection on these varieties was about equal. (Anderson).

Control of bacterial shot hole

The greater prevalence of the disease is usually associated with undernourished trees, although recommended methods of treatment are not always giving the desired results. More satisfactory and thorough methods of control must apparently be developed for certain sections.

Delaware: The dormant spray had practically no effect in control of disease this season. The following results were secured on a block of Elberta. Applications of manure (10 pounds to tree) with two later applications of nitrate of soda (2 pounds each) gave practical control. A 7-6-5 fertilizer supplemented with 2 pounds nitrate of soda gave the next best results. These treatments were superior to two applications of nitrate of soda and a 4-4-2 fertilizer at the rate of 300 pounds to the acre. The orchard was located on a light sassafras type of soil. (Adams).

South Carolina: This seems to have been quite widespread this season and in some places to have caused considerable defoliation. My observation on some nitrate treated and check plots this season leads me to believe that fertilizer with nitrate does not induce greater resistance. It does stimulate leaf production, though, so that the same loss of tissue due to the spots or to defoliation is not so

serious to the fertilized trees. A better control measure is needed but fertilization is worth while. Seemed to be worse early in the season this year. (Ludwig).

Indiana: Disease worst this year since 1913 and believe it is more serious after a mild winter. (Burkholder).

Nitrate of soda 3-5 pounds per tree applied ten days to two weeks before bloom gave same control. (Cullinan).

Literature, not cited

Anderson, H. W. A survey report of the bacterial shot-hole of peach. Trans. Illinois State Hort. Soc. 55: 137-144. 1921.

Rust caused by Puccinia pruni-spinosae Pers.

This disease is reported from the southern states in the peach belt, but not of economic importance. It was reported from South Carolina, Georgia, Florida, Louisiana, and Texas. It was generally observed to appear late in the season. Ludwig states that if infestation was as severe early in the season as at the close, considerable damage would probably be done, but infestation does not usually become severe till the leaves are nearly ready to drop.

The alternate hosts for this heteroecious rust are species of Hepatica, Anemone, and Thalictrum. According to the data in the North American Flora (7: 151-152, 1907), the alternate host, a species of Anemone, has been listed only from Louisiana for the states reporting the disease this year.

Blight caused by Coryneum beijerinckii Oudem.

The disease was much less prevalent than during the average year and was reported from Ohio, Colorado, Idaho, Washington, and Oregon. In Washington it was very much reduced over the amount in normal years and actual losses in commercial orchards were small. (Dana). Barss reports the following situation in Oregon:

"General throughout wsetern Oregon. Twig and bud damage last winter about average. Dry spring weather has resulted nearly everywhere in apparent absence of fruit spotting thus far. Easily controlled by early fall spray of Bordeaux but so much neglected that in some sections unsprayed trees may suffer 35% damage."

Black mold rot caused by Rhizopus sp.

This rot was very consistently observed by the market inspectors and its prevalence on the basis of market reports was more extensive than brown rot. The rot was reported by Stokdyk from Kansas, and Anderson reports as follows from Illinois:

"My observations during the past three years lead me to believe

that in the absence of serious brown rot in the field, Rhizopus rot is the cause of most of the loss in transit and market. The amount of this rot found in shipped peaches this year is about ten times greater than brown rot. It spreads through the baskets very rapidly."

Examination of 100 cars of peaches by the food products inspectors of the Bureau of Agricultural Economics between the dates of July 3 and October 15, 1922, showed black mold rot in amounts varying from a trace to as high as 65% of the load. These peaches came from the following states: California, Colorado, Georgia, Idaho, Illinois, Maryland, Michigan, New York, North Carolina, Oregon, Utah, Virginia, and Washington.

Yellows (cause unknown)

Yellows continues to be observed in the same regions from which it has been reported in the past five years. There is apparently no progressive increase in its prevalence according to collaborators' reports. Intensive surveys conducted in Pennsylvania by McCubbin have revealed the specific importance of the disease and the success of eradication campaigns in reducing the amount. In New York, since the growers are very careful to remove trees as soon as yellows are plainly visible, the disease has never been important, according to Chupp. In Pennsylvania, McCubbin reports that in 1922 2.5% of 440,000 trees were affected compared with 4.4% in 1921, largely in the same orchards. Collaborators report the disease from the following states: Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, West Virginia, and Ohio.

Recent literature

Cook, M. T. The dissemination of peach yellows and little peach. Phytopath. 12: 140-142. Mar. 1922 (June).

Rosette (cause unknown)

Rosette was reported only from Florida and Georgia this year. In Georgia, according to McHatton, the disease is distributed throughout the state, but is more serious in the Piedmont section.

Little peach (cause unknown)

Little peach was reported from New Jersey and Delaware.

Root knot caused by Heterodera radicicola (Greef) Müll.

Root knot was reported from South Carolina, Mississippi, Texas, and Georgia. Ludwig estimates a five percent reduction in yield in South Carolina. In Mississippi the disease is very common and serious on nursery stock. One nursery near Meridian revealed at least 75% infection. On the whole this disease is a very serious problem for the nurserymen in many localities of the state. (Neal).

McClintock has given the following progress report on the control of root knot:

> "Experiments conducted by the writer at the Georgia Experiment Station during the past three years have shown the possibilities of root-knot control through the use of resistant plants. Various plants have proven resistant to the root-knot nematode, the most recent addition to the list being a seedling peach. Seed of this peach have been planted to determine whether the factor of resistance is seed transmitted in the case of this peach. As data are collected a report will be made relative to this point, and in the meantime workers should watch for resistant individuals among various plants which are infested by root-knot nematodes."

Miscellaneous parasitic diseases

Crown gall caused by Bacterium tumefaciens EFS & Towns. The disease was reported from South Carolina, Georgia, Florida, Texas, Ohio, and Arizona. In South Carolina, Ludwig observed 15-20% of the trees in a 7-year old orchard seriously affected. In Arizona 5-7% of the crop was injured. (Brown). In Ohio the Early Crawford was observed to be a susceptible variety. (Thomas).

Die back associated with Valsa leucostoma Fr. Generally associated with weakened trees as the result of winter injury or weakened, undernourished trees. Reported from South Carolina, Georgia, Ohio, Indiana, and Kansas.

Powdery mildew caused by Sphaerotheca pannosa (Fries) Lév. persicae Woronichine. This disease was of slight prevalence this season and generally considered of slight economic importance. Collaborators reported it from the following states: New York, Delaware, Texas, Missouri, Washington, and Oregon. Leaf and twig infection was more prevalent than usual but not rated important. (Adams). Reported general in western Oregon, but losses not large. (Barss).

Shot hole caused by Cercospora circumcissa Sacc. Reported from Ohio and Michigan. Thomas states that he is uncertain whether one or more organisms are concerned in producing shot hole disease in Ohio.

Wilt caused by Verticillium albo-atrum Reinke & Berth. Observed on five commercial varieties in New Jersey. Disease did not appear in 1922 in orchards where it was noted in 1921. (Haenseler).

Frosty mildew caused by Cercosporella persicae Sacc. This disease appeared on the leaves about the time they began to shed normally, but caused no damage in Florida. (Tisdale).

Root rot caused by Clitocybe sp. and Armillaria sp. Elliott reported 5% reduction in yield because of these pathogenes.

Root rot caused by Ozonium omnivorum Shear. Reported commin in the southern part of Arizona. (Brown).

Root rot (not determined). A condition causing premature death of trees and destructive in "sassafras" section (Brown County), Indiana. (Gardner).

Miscellaneous non-parasitic diseases.

Phony peach. This disease, previously observed and reported by Neal from Georgia, is being investigated by L. M. Hutchins of the Office of Fruit Disease Investigations. A typical case of the so-called "phony" disease was observed this season in Clarke County, Mississippi, August 15. (Neal).

PEACH - Miscellaneous non-parasitic diseases.

Sun scald. Gardner in Indiana reports sun scald "worse where Bacterium pruni had caused defoliation, exposing fruit to sun. Spots on upper, exposed surfaces of fruit, usually near stem. Killed area surrounded by red halo. On unsprayed as well as sprayed trees, hence not spray burn." Anderson reports from Illinois as follows: "Numerous orchardists south of Carbondale report serious loss due to a peculiar condition of the fruit. This shows as a dark sunken spot from one-fourth to one-half inch in diameter near the stem and on the upper surface. Gum often exudes. The flesh is dry immediately below the lesion but not far into the pulp. Found almost exclusively in poorly nourished orchards, while the cause has not been definitely established it is supposed to be due to a few very hot days the latter part of June."

Split pit. Reported from Washington, causing some loss in a number of commercial orchards. Not confined to certain trees or locations. (Dana).

Chlorosis. Reported from Texas by Taubenhaus. A possibly similar condition reported as rosette or yellows from Washington by Dana is commented upon as follows: "A very serious case of rosette involving all the trees in a ten acre block of young trees planted after older trees had been removed came to our attention from Wawawai on the Snake River. The fertility of the soil was evidently run down in the old orchard before its removal, making its effect on young orchard planted later." (Dana).

Frost injury. The extent of injury in the commercial peach belt was considerably less than last year. The injury was very local in some sections and associated with "frost pockets." Georgia, Florida, and Alabama show less production than last year which is apparently because of frost injury. The following comment is from the Bureau of Markets and Crop Estimates, Semi-Monthly Crop Notes 1922: 1. May 5, 1922.

> "Stone fruits were not damaged much in New Jersey, but in Delaware and western Maryland, peaches were quite severely injured. In Virginia about half of a full crop of peaches is expected, but they are said to be killed in the Lake Erie district of Ohio."

Spray injury. Reported from Connecticut, New York, Delaware, and Illinois. Clinton reports the injury is mostly in the form of "shot hole" in Connecticut. Atomic sulphur and lime sulphur are two of the sprays used with injury, also some dust injury. Adams reports in Delaware that "Spray injury on peaches has been more prevalent than upon apples this season. Copper sulphate, 6% strength was used as a delayed dormant upon a block of Elberta and Belle of Georgia varieties. The injury resulted in producing a die-back effect on all the last season's growth. The injury was most severe in the upper parts of trees since the spray was directed from a tower on the spray tank. The Belle of Georgia was most susceptible to the toxic spray while the Elberta showed little reaction. The 80-10-10 dust in late applications has caused prevalent burning or scorching of fruit. Atomic sulphur and arsenate of lead in greater proportions than recommended produced serious leaf injury, resulting in defoliation."

Illinois: An unusual amount of foliage burn resulted from all sprays applied early in the season. Dry lime sulphur was used in many orchards but did not appear to cause more injury than the self-boiled. (Anderson).

PEACH - General references

Recent literature

Britten, W. E., M. P. Zappe, and E. M. Stoddard. Experiments in dusting versus spraying on apples and peaches in Connecticut in 1921. Connecticut Agr. Exp. Sta. Bul. 235: 209-226. Feb. 1922.

Brooks, Charles, and D. F. Fisher. Transportation rots of stone fruits as influenced by orchard spraying. Jour. Agr. Res. 22: 467-477. Nov. 26, 1921 (Apr. 1922).

_____ and J. S. Cooley. Temperature relations of stone fruit fungi. Jour. Agr. Res. 22: 451-465. Nov. 26, 1921 (Apr. 1922).

Cayley, D. M. Die back of stone fruits. Gard. Chron. III, 71: 71. Feb. 11, 1922.

Halligan, C. P., R. H. Pettit, and G. H. Coons. Spray and practice outline. Michigan Sta. Spec. Bul. 114: 3-28. 1922.

Johnston, E. S. Undercooling of peach buds. Amer. Jour. Bot. 9: 93-98. March 1922.

McClintock, J. A. Aerial galls of peach. (Abstract) Phytopath. 13: 45. Jan. 1923.

PLUM AND PRUNE

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt.

There was a general increase reported in the Atlantic states, while in the Middle West and Pacific states the prevalence was the same or less. In many sections the loss was said to be due to fruit rot resulting from neglected spraying. Blossom and twig blight were of very slight prevalence, according to the reports by collaborators. The following list indicates the prevalence of the disease as compared with the average year.

More - Vermont, Massachusetts, New York, New Jersey, Pennsylvania, Delaware, Maryland, Texas, Wisconsin.
Same - Connecticut, West Virginia, Ohio, Illinois, Arkansas, Iowa, Kansas.
Less - South Carolina, Minnesota, Oregon

Table 98. Showing estimated percentage reduction in yield, as reported by collaborators:

State	Estimated percentage reduction in yield	State	Estimated percentage reduction in yield	State	Estimated percentage reduction in yield
Vermont	15	Maryland	6	Illinois	5
Connecticut	15	West Virginia	5	Minnesota	1.5
New York	12	South Carolina	4	Iowa	20
Pennsylvania	40	Texas	10	Kansas	5
Delaware	2	Arkansas	20	?	

Vermont: Much more than normally. Very few will take the trouble to spray or remove the old mummies. (Lutman).

Massachusetts: Prevalent throughout the state and causing considerable damage. (Osmun).

Pennsylvania: General throughout the state. Most reports indicate heavy losses, running as high as 50-60%. (Thurston, Sept. 30).

Illinois: More abundant this year than last. In some cases a blossom blight with twig cankers has occurred this year, similar to our previous reports for peach. (Tehon, Aug. 1).

North Dakota: We have had one case of brown rot called to our attention this year. This is the first report I have had during the past four seasons, and, as far as I know, it is not on record here as having occurred in other seasons. Specimens and cultures showed the typical conidia. (Weniger).

Oregon: Present but not as serious as usual in extent of damage this year. Dry weather started early in the season and very little continued rain was present through the ripening and harvest period. Some losses, however, occurred locally in western Oregon following fall rains. (Barss).

Observations of earliest occurrence, reported by collaborators in 1922.

April 4 ... Kansas	June 22 ..... Jefferson County, Ill.
May 10 .... Nassau County, N. Y.	June 22 ..... Galax, Virginia
May 23 .... Lucas County, Ohio	June 30 ..... Southington, Conn.
May 29 .... Minnesota	July 14 ..... Westminster, S. C.
June 9 .... Grant County, Ind.	August 1 ..... Vermont
June 15 ... Newark, Delaware	August 15 .... Marion, N. Dak.
June 20 ... Cobb, Wisconsin	

Observations upon the appearance of apothecia and ascospore discharge were reported from several states. In Delaware mature apothecia were observed April 10. (Adams). Thomas reports brown rot infection of plums was noted to occur earlier than usual this year in Ohio. The first ascospore discharge was observed April 26, this being followed by serious blossom blight. Apothecia were first observed May 5 in Minnesota and twig blight observed May 29.

Varietal susceptibility

Clinton reports the Climax and Shiro very susceptible in Connecticut. Blossom blight was especially marked in Ohio on certain American hybrids, such as Sapa, Ohta, Hanska, etc. (Thomas). Vaughan reports that in Wisconsin, where there was more than the average amount of brown rot, more European plums were bearing than usual. The soft plums, some of which are highly susceptible, are seldom grown commercially in Oregon. (Barss).

From the results of their studies on the effects of brown rot on plums, Villaman and Sandstrom conclude that in the field an important factor in resistance is the thickness of the skin. Varieties showed not only different rates of rot-

ing, but the character of growth of the fungus differed as to amount of fruiting, which was in general greater on the surface of the fruits of susceptible varieties.

Control

Dutton and Johnston[1] have recently reported on the results of spraying and dusting in Michigan for 1920 and 1921.

Literature

Cited

1. Dutton, W. C. and S. Johnston. The control of brown rot of peaches and plums. Michigan Sta. Spec. Bul. 115. pp. 28-39. 1922.
2. Willaman, J. J. and V. M. Sandstrom. Biochemistry of plant diseases. III. Effect of Sclerotinia cinerea on plums. Bot. Gaz. 73: 287-307. April, 1922.

Not cited

Willaman, J. J. and F. R. Davison. Biochemistry of plant diseases. IV. Proximate analysis of plums rotted by Sclerotinia cinerea. Bot. Gaz. 74: 104-109. Sept. 1922.
Wormald, H. Further studies of the "brown rot" fungi. I. Ann. Bot. 36: 305-320. pl. 13-14. July 1922.

Pockets caused by Exoascus pruni (Berk.) Fckl. and E. communis Sad.

Plum pockets was reported from four more states than last year, and the information submitted indicates a greater prevalence than usual in 1922. Collaborators reported the disease from New York, Maryland, West Virginia, Texas, Illinois, Iowa, and Kansas. Dr. J. W. Roberts, Office of Fruit Disease Investigations, states:

> "The complaints concerning this disease have been more numerous than usual. Specimens have been received from Kansas, Nebraska, and Idaho. This disease has long been very destructive to the wild plums in Nebraska and Kansas."

In New York more than the average number of specimens were received for identification at the laboratory, according to Chupp. There was more than usual in Illinois where it was very serious locally and especially abundant in the southeastern section. (Tehon). In Wisconsin there were many reports from central and northern counties. European varieties were little diseased, but Americana and hybrid varieties were most affected. (Vaughan). It was very common and destructive in Iowa. (Melhus). In Missouri the disease has been especially severe on the wild goose plum and quite a number of specimens have been sent in. (Hopkins). Goss reports a very heavy infection of plum pockets this year in Nebraska. In North Dakota heavy infection was observed on Prunus americana, Prunus pumila, and Prunus virginiana. A five percent loss of fruit

was estimated on these hosts. (Weniger).

The estimated reduction in yield for states was reported by collaborators as follows: Illinois and Kansas 1%, Iowa 3%, Texas .5% and New York, Maryland, and West Virginia a trace.

Dates of first appearance, according to collaborators

May 12 .... Brunswick, Missouri	May 29 .... Minnesota
May 19 .... Riley, Kansas	June 1 .... Prairie du Sac, Wis.
May 25 .... Butler County, Ohio	June 6 .... Otsego County, N. Y.
May 29 .... Shelby County, Indiana	

Leaf blight caused by Coccomyces prunophorae Higgins

Leaf blight of plums was reported from Vermont, Massachusetts, Connecticut, New York, Arkansas, Ohio, Illinois, Minnesota, Kansas, and Oregon. In general, it was not severe. In Massachusetts it was generally present causing serious loss of foliage, especially on European varieties. (Osmun, Aug. 1). In New York it was said to be general, and important in some orchards. (Chupp). Leaf spotting was reported throughout Illinois and was slightly more prevalent than the average year. (Tehon). In Minnesota heavy infections were observed on the University Farm, and light to moderate infections in the Minnetonka fruit-growing district (Department of Plant Pathology). In Oregon the disease was reported by Barss as follows:

> "Reported as slight in general as compared with previous years. Showed up according to fruit inspector Van Trump south of Salem late in the season, in some orchards causing considerable damage. Spraying with Bordeaux reported as of considerable benefit. Early and prolonged dry weather conditions starting soon after bloom undoubtedly checked the disease at the start of the season."

Dates of first observation, 1922

June 13 .... Clinton County, Ill.	July 11 .... Montgomery Co., Kans.
June 22 .... Chautauqua County, N. Y.	July 12 .... Hamilton County, Ohio
June 23 .... Minnesota	September 10 Vermont

Literature

Dutton, W. C. and S. Johnston. Leaf spot control on cherries and plums. Michigan Sta. Spec. Bul. 114: 46-50. 1922.

Bacterial spot caused by Bacterium pruni EFS

Bacterial spot was apparently much less prevalent on plum than on peach. The range of distribution on the two hosts is the same, but much fewer reports of its occurrence on plum are received from the states in the commercial peach belt.

According to J. W. Roberts, it is very severe on Japanese plums but seldom reported. It has been an important factor in wiping the Japanese plum out

of commercial planting in the South. The disease is established in west Florida where it was reported as quite severe this spring. (Burger). Taubenhaus reported it as causing a one percent loss in Texas. It was reported general throughout Illinois where the injury due to it is confined almost entirely to the leaves. (Tehon). The following additional states reported the occurrence of bacterial spot of plum: New York, Delaware, Ohio, Indiana, Wisconsin, Iowa, and Kansas.

Black knot caused by Plowrightia morbosa (Schw.) Sacc.

The occurrence of black knot on plum as it has been reported by collaborators is coextensive with the host. Dr. J. W. Roberts (Office of Fruit Disease Investigations) states that, "If one may judge by inquiries received, this disease has been more than usually severe during 1921 and 1922." Collaborators reported it from Massachusetts, Connecticut, New York, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Ohio, Indiana, Illinois, Wisconsin, and Colorado. In New York carefully pruned and sprayed trees are usually free from the knots. (Chupp). Thurston states that it is very abundant but not more serious than usual in Pennsylvania. It is reported as probably the worst trouble of plums in West Virginia. (Giddings). Thomas in Ohio reports that general knowledge of control of black knot renders its spread less than in former years.

Miscellaneous diseases

Blue mold rot (Penicillium), Rhizopus rot (Rhizopus) and gray mold rot (Botrytis) - Heavy losses to plums and prunes in storage and transit occurred because of these rots.

Scab caused by Cladosporium carpophilum Thüm. Reported from Illinois, Wisconsin, Minnesota, and Kansas. Anderson reports its first observation in Illinois where it is common on some kinds, but absent on most of the important commercial varieties. Reported August 8 on fruit at Waterloo, Wisconsin and also found in wild plums near Madison by Dr. Bensaudo. (Vaughan).

Sooty blotch and fly speck - Fly speck (Leptothyrium pomi) was observed on fruit of neglected trees at Houston, Delaware, August 9. (Adams).

Sooty blotch, caused by a fungus apparently the same as that on apple, was identified by J. W. Roberts on plums from the vicinity of Washington, D. C. The specimens were rather badly affected. Roberts states that the disease is occasionally found on plums, especially those maturing late.

Rust caused by Puccinia pruni-spinosae Pers. was reported from Louisiana and Texas.

Bacterial gummosis, cause not determined. Observed in California. Horne states that it is an "imperfectly understood disease difficult to diagnose in many cases, especially difficult in twig and bud forms." Trunk injury is found on many varieties. The disease is less severe on plum than on apricot. It occur on almond, cherry, and perhaps all stone fruits.

Rosette, cause not determined. Dana in Washington reports "one very serious case of rosette on Burbank plum was observed in the Snake River section. The trees were just coming into bearing, having been set in a block from which old peach trees had been removed."

Yellows, cause unknown. Observed by Dye on a plum tree next to affected peach trees at Rochester, Monroe County, New York.

Crown gall caused by Bacterium tumefaciens EFS & Towns - Reported from Indiana and Arizona. George reports it very serious in one orchard near Glendale Arizona.

PLUM AND PRUNE - Miscellaneous

Chlorosis -said to be due to too much lime in the soil. Reported from Texas.

Silver leaf - a species of Stereum seemingly secondary but associated with silver leaf, reported August 15 from Sturgeon Bay, Wisconsin. (Vaughan).

Frost injury - reported locally severe in West Virginia and Delaware but causing no serious damage.

Cork spot - cause not determined. What appears to be the same trouble is reported from Illinois and Kentucky. Anderson states that in Illinois " a number of samples of plums have been received showing a corky area on the upper face. This area extends to the seed and is usually depressed at the surface sometimes showing convolutions. It was observed in the University orchard and was confined to two or three varieties."

Valleau reported a trouble which he designated as "hard flesh spots" in Kentucky, as follows: "A disease of plums has been noticed the past season in the Experiment Station orchard, especially on Omaha plum. It results in depressions on the surface of the fruit which are bluish in color. The flesh under the depression is hard and shrunken. This condition extends usually to the pit, although in some other varieties the diseased tissue may be a smaller mass just under the skin. The spot does not seem to spread. When plums are cooked which have only a mild case, the diseased tissues remain as a hard ball of tissue often attached to the pit. The same disease was noticed several years ago on two or three Prunus Americana x P. triflora hybrids at the Minnesota fruit breeding farm. It is not a spray injury as it has been seen on unsprayed trees. Only triflora or triflora hybrids have so far been seen which are affected."

Gum spot and internal browning - causes not determined, apparently connected with the very hot and dry growing season, were reported from Oregon (Barss, Pl. Dis. Bul. 6: 143. 1922).

Top soursap - cause not determined. Reported by Horne from California as "severe generally on very porous soils and on shallow soils. Growers believe in some localities that trees on Myrobolan root have suffered more than on peach root in these soils."

Spray injury - reported by Dana from Washington.

Mistletoe was reported by Brown in Arizona as occurring in "two specimens of yellow egg plum that were found attacked by Phoradendron flavescens. The hosts were growing in the Aravapai and San Pedro Valleys near cottonwoods heavily laden with the mistletoe."

CHERRY

Leaf spot caused by Coccomyces hienalis Higgins

There was a general increase in the prevalence of leaf spot of yellow leaf of cherry, particularly in the commercial cherry region of the lower Lake states. Weather conditions were particularly favorable for the establishment of the disease this spring. It is usually found that conditions favorable to epidemic outbreaks of this disease are quite similar to those favoring apple scab. Defoliation, and the resultant undersized fruit, weakening of the trees making them more subject to winter injury, and loss of next year's blossom buds were reported as due to severe infestation by this fungus. Gardner observes that in Indiana Gummosis, devitalization of trees, and borer attack are associated with premature defoliation caused by this disease. Very severe on all unsprayed trees.

CHERRY - Leaf spot

The prevalence of the disease compared with the average year as reported by collaborators in 1922:

More :	Connecticut, New York, Pennsylvania, Maryland, Ohio, Indiana, Illinois, Michigan, Wisconsin, Iowa, Kansas
Same:	Massachusetts, Delaware, Virginia, West Virginia, Arkansas, Missouri
Less:	Oregon

The following estimates of the percentage reduction in yield were reported by collaborators: 25, Ohio; 15, Kentucky; 19, Pennsylvania; 8, Maryland; 5 to 7, New York; 6, Iowa; 5, Arkansas, Indiana, Kansas; 1, Delaware; trace, West Virginia, Illinois.

New York: Very severe on all unsprayed trees. (Chupp).

Pennsylvania: The cherry leaf spot appears to be epiphytotic throughout central and southeastern Pennsylvania, causing considerable defoliation. (Thurston, June 27).

Virginia: Leaf spot is general and severe on unsprayed trees. One hundred percent infection and 10% defoliation noted July 14. Many people believe it is natural for the cherry to lose its leaves in midsummer. (Fromme, July 19).

Ohio: Defoliation of cherry trees very common early in August. In southern Ohio many trees blossomed the second time late in August. Fifty-seven reports have come to us this year. (Thomas).

Indiana: The worst cherry disease. Generally distributed in state and early rains very favorable to disease. (Gardner).

Illinois: Cherry leaf spot is very prevalent and causing almost complete defoliation on the sour cherries throughout southern Illinois. It is also generally prevalent in all parts of the state where I have been. I think it would be safe to say that it is general throughout the state and unusually severe. (Anderson).

Michigan: Worst in years. Crop loss in Grand Traverse and surrounding counties so far as salable fruit of size is concerned, total in some orchards. Spraying careless or neglected. College spraying experiments have given perfect control in that region. Trade papers estimate loss in yield in cherry district at 10%. Local papers estimate loss at 25%. Higher figure seems probable from appearance of majority of orchards seen from road on recent trip through northern section. In Berrien County loss slight. In Van Buren County loss extremely heavy. Dust has given good control with Morello in Grand Traverse County. (Farrand).

CHERRY - Leaf spot, brown rot

Earliest appearance of disease, according to collaborators. 1922.

May ..... Fayetteville, Arkansas	June 13 ..... Clinton County, Illinois
May 19.... Bloomfield, Missouri	June 15 ..... New Castle, Delaware
May 27.... Montgomery County, Ohio	June 25 ..... Ulster County, New York
June 6 ... Madison County, Indiana	June 27 ..... Pennsylvania
June 6 ... Wabaunsee, Kansas	July 14 ..... Bedford, Maryland
June 8 ... Madison, Wisconsin	July 22 ..... Stamford, Connecticut

Varietal susceptibility

The following varieties were observed severely affected in New York: Richmond, Montmorency, and Morello. (Chupp). Prevalent on sweet and sour cherries in Delaware. (Adams). Burkholder reports the disease was not well controlled in the Wragg and Morello by sprays in Indiana.

Control measures

Clinton states that lime sulphur and Bordeaux mixture gave good results in control in spraying experiments in Connecticut. In Ulster County, New York both dusting and spraying have given good control of cherry leaf spot with a small difference in favor of spraying. Observations in Onondaga Co., N. Y., show that the disease was most abundant in orchards that did not receive the petal fall application and one at the time the shucks were coming off. Apparently the shuck spray was the critical one. Clean cultivation noticeably helps in its control in Indiana, according to Burkholder. Vaughan reports satisfactory control in Wisconsin with three sprays of Bordeaux mixture 3-3-50 but lime sulphur was not so successful. In Kansas either Bordeaux mixture or lime sulphur controls it satisfactorily if applied at right time. (Stokdyk). Johnston[1] and Dutton, as the result of experiments during 1920 and 1921, in Michigan, report, "lime-sulphur solution, Bordeaux mixture, sulphur dust, and dehydrated copper sulphate dust being used. On the cherry trees, the results on the whole show that Bordeaux mixture ranked highest in leaf-spot control, but caused many of the leaves to fall. Lime sulphur ranked second, and the dust applications a little lower than the lime sulphur."

Literature

1. Dutton, W. C. and S. Johnston. Leaf spot control on cherries and plums. Michigan Sta. Spec. Bul. 115: 46-50. 1922.

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt.

The prevalence of brown rot compared with the average year was reported as follows: More - Connecticut, New York, Pennsylvania, and Indiana; average - Delaware, Arkansas, Ohio, Wisconsin, Iowa, Kentucky, Tennessee, and Oregon; less - West Virginia, Illinois, and Kansas. The most general injury was in the form of fruit rot. Blossom and twig blight were of slight prevalence. In New York brown rot on blossom pedicels of cherries was more general and severe than usual. (Chupp) In Orleans and Monroe Counties, N. Y. the rot was very severe on sweet cherries. (Smith and Pierstorff). Barss reports the blossom blight as common in western

Oregon but causing slight damage in most sections. In the Umpqua Valley it was reported about the same as last year, injuring up to 10% of the bloom. The percentage loss by states as reported by collaborators is as follows:

Connecticut	15	West Virginia ...	5	Indiana	t
New York.....	8	Kentucky 10		Illinois ...	1
Pennsylvania ...	10	Tennessee	5	Wisconsin ...	t
Delaware	2	Arkansas	4	Washington ..	.5
Maryland	3	Ohio	2		

Dates of first occurrence of disease observed by collaborators. 1922.

March 24 ... Pratt, Kansas	June 15.... New Castle Co., Dela.
May 1 ..... Wayne County, N. Y.	June 22 ....West Hartford, Conn.
May 25 ..... Crawford County, Ohio	July 3 .... Edwards County, Ill.
June ..... Fayetteville, Ark.	July 15.... Sturgeon Bay, Wis.
June 1 ..... Knox County, Indiana	

Control of brown rot

In Connecticut neither dusting nor spraying was very effective. (Clinton). In New York it is deemed advisable that the pre-blossom spray (or dust) for the prevention of brown rot blossom blight of cherries should be applied at a stage of development corresponding to that in peaches when this application is recommended. Lime-sulphur 1-50 or 90-10 sulphur arsenate dust is recommended for peaches when the blossoms show pink in that state. In Oregon, Barss reports that Bordeaux applied as the blossoms open was very beneficial.

Miscellaneous diseases

Powdery mildew caused by Podosphaera oxyacanthae (Fr.) De Bary. The usual average prevalence was reported from Vermont, West Virginia, Ohio, Indiana, Illinois, Iowa, and Kansas. Lutman stated that it was more common in Vermont than he had ever seen it before. It was reported more or less general in Ohio. Melhus estimated a 3% reduction in yield for Iowa.

Black knot caused by Plowrightia morbosa (Schw.) Sacc. Reported from New York, West Virginia, Ohio, Minnesota, and Idaho. It is generally distributed in West Virginia and one of the worst troubles with sour cherries, causing a reductio in yield estimated at 5%.

Crown gall caused by Bacterium tumefaciens EFS & Towns. Reported by Dana from Washington.

Bacterial gummosis caused by Bacterium cerasi Griffin - reported from Washington, and Oregon. "Reported from all over western Oregon. Apparently as bad or worse than last year. Some orchards in Lane County reported free from trouble; others damaged up to 15 or 20%. Cate reports that many large limbs are being affected in Ashland district where the disease appears worse than last year in many places. None reported from east of Cascades." (Barss).

Scab caused by Cladosporium carpophilum Thüm. Reported from Iowa by Melhus

CHERRY - Miscellaneous; APRICOT - Brown rot

Root trouble, cause not determined. In Chautauqua County, New York many complaints of root troubles on cherries are being received. Winter injury and root rot are both probably prevalent. (Palmer).

Fruit rot, caused by fungus not determined. Reported by Dana from Washington.

Imperfect pollination. Thomas in Ohio reports upon imperfect pollination that is similar to reports by several investigators on apples. "Because of the continued cool wet period at the time cherries were in full blossom which resulted in very limited activities of bees, there is a surprisingly large number of cases of imperfect pollination resulting in a heavy dropping of fruit. These hollow or bladdery fruits are characteristic in having no seed."

Spray injury. Clinton reports injury where lead arsenate and nicotine sulphate were used on cherries in Connecticut, although lilac and tulip trees sprayed at the same time were not injured.

Frost injury was reported by collaborators from Delaware and Washington, and Adams estimates a 20% reduction in yield for Delaware. In Washington Dana reports that the injury assumed the form of a shot-hole type on the leaves. According to "Weather, Crops, and Markets" the April freeze caused loss to cherries in New England, Pennsylvania, Maryland, Delaware, Kentucky, West Virginia, Ohio, Indiana, and Illinois.

Winter injury was reported from Ohio and Washington. Dana has reported injury largely due to severe winter of 1919-20 becoming apparent during the present season and showing up in severe form in the Snake River and Columbia River Valleys. Anderson reports that in Illinois a number of cherry trees in various parts of the state died very suddenly this year from an unknown cause, possibly winter injury.

Literature

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Tonneson, C. A. Gummosis of the cherry. Better Fruit, 16(9): 14, 15, 22. 1922.

APRICOT

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt.

The presence of fruit rot was reported from two states in the East - New York and Connecticut. In the Pacific Coast states there was a general increased prevalence reported from California and Oregon. The injury was for the most part in the form of blossom and twig blight. Fields reported that the fungus did much damage in Santa Clara Valley this year and was present also in other localities in California. Barss stated that in Douglas County, Oregon (not a large crop) blossom and twig blight were bad, worse than last year, causing about 50% loss, according to the County Agent. In Hood River and Wasco Counties, which are the chief apricot sections, twig and blossom blight were very severe in some localities and orchards.

APRICOT - Other diseases

Literature

Rudolph, B. A. Apricot brown rot control. Calif. Agr. Exp. Sta. Cotr. to Circ. 238 (2) p. June, 1922.

Other diseases

Blight caused by Coryneum beijerinckii Cudem. -Only two reports were received on this disease, although it is known to be present in other states. In Idaho it is considered the most important apricot disease and the spotting of fruit in the markets was quite common this year. (Hungerford). The disease was reported from Douglas and Josephine Counties, Oregon as abundant, producing about 5% loss. All varieties were reported affected. (Barss).

Shot hole caused by Cylindrosporium padi Karst.- reported from Texas. (Taubenhaus).

Bacterial spot caused by Bacterium pruni EFS - First report for Illinois; found twice (Saline and Massac Counties) in the extreme southern part of state. First observed July 22 at Carrier Mills, Saline County.

Crown gall caused by Bacterium tumefaciens EFS & Towns. - Reported to cause 2 to 5% loss in Arizona. (Brown).

Frost injury - Apricots were seriously injured by the frosts in California during the second week in April. No reports are available on injury in other sections in the commercial apricot sections of the West. The following account appeared in the California Citrograph 7: 263. June, 1922:

> "Several deciduous fruit crops in both northern and southern California were seriously damaged by cold weather during the first two weeks of April, according to recent reports.
>
> "As a result, the season's apricot crop will be very materially reduced in all sections, it is stated. Added to a loss by dry rot for this fruit in the central part of the state, the frost damage will probably cut down the estimates on the apricot crop for this year by one-half."

Scab caused by Cladosporium carpophilum Thüm. Fruit infection observed in July at Wallingford, Connecticut (Clinton); and an estimated reduction in yield of 1% was reported for Texas. (Taubenhaus).

Root knot caused by Heterodera radicicola (Greef) Müll. Reported as common in Arizona. (George).

Literature

Howard, W. L. The apricot in California. California Sta. Circ. 238 (1922), pp. 53, figs. 9.

DISEASES OF SMALL FRUITS

GRAPE

Frost injury

Injury to grapes occurred during the latter part of April and the first week in May. Very little information was submitted by collaborators and most of the information has been obtained through the monthly summary in "Climatological Data" for April and May. The injury was most prevalent in some of the Atlantic and Lake states and the Pacific Coast states. In New York during April and on May 1 frost damage was considerable. Grapes in Chautauqua County were injured to the extent of 25%. Observations in Delaware show that frost injury on grape was less severe than last year. The greatest loss was experienced in low sections. It was observed in the Dover section that growers practicing early cultivation experienced the greatest loss through freezing of buds. Adjacent vineyards where cultivating was done after bud opening showed no frost injury. (Adams). During the last two weeks in April frosts and freezing temperatures occurred on several days doing considerable damage in limited areas to grapes in Indiana. April frosts did some damage to grape vines in the northern and central portions of California.

Black rot caused by Guignardia bidwellii (Ellis) V. & R.

Because of the reduced setting of fruit last year due to frost injury many vineyards were not thoroughly sprayed. As a result, the disease became serious favoring an increased wintering over of the fungus. With favorable weather conditions a general epidemic could be predicted, but failed to materialize except in the northeastern states as a group. The relative prevalence compared with the average year is indicated in the following list.

More	- New Hampshire, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, Delaware, Maryland, Ohio, Michigan, Illinois, Wisconsin, Arkansas, Texas, Kansas.
Same	- New Jersey, West Virginia, Virginia, South Carolina, Georgia, Florida, Mississippi, Louisiana, Indiana, Missouri, Iowa, Minnesota.

The disease was most important as a fruit rot but serious leaf and twig infection was reported in some sections. Weather conditions were favorable for its early appearance on the fruit and infected fruit was generally observed during the month of July.

Collaborators reported the following percentage reduction in yield:

New Hampshire	t	Tennessee	20	Ohio	5
Connecticut	20	South Carolina	12.5	Indiana	2
New York	2	Georgia	10	Illinois	3
Pennsylvania	5	Mississippi	5	Wisconsin	5
Delaware	5	Louisiana	t	Minnesota	t
Maryland	10	Texas	8	Iowa	5
Kentucky	25	Arkansas	8	Kansas	2
		West Virginia	20		

Observations on the earliest occurrence of the disease according to collaborators:

April 10 ... Perry County, Ohio
May ..... Fayetteville, Ark.
May 1 ..... Clemson College. S. C.
June ..... Agricultural College, Miss.
June 2 ..... Dakota County, Minn.
June 9 ..... Dover, Delaware
June 9 ..... St. Clair County, Ill.
June 9 ..... Washington County, Mo.
July 1 ..... Ulster County, New York
July 7 ..... Allen County, Ind.
July 9 ..... Shelton County, Conn.
July 12 .... Montgomery County. Kans.
July 13 .... Massachusetts
July 13 .... Abingdon, Virginia
July 17 .... Monroe, Wisconsin
July 22 .... Dover, New Hampshire
August 15 .. Vermont

Control of black rot

It is apparent that thorough control was not secured this year because of failure to correctly time the early application. Early applications of Bordeaux mixture 4-4-50 gave partial control in Delaware. (Adams). Black rot is controlled by careful spraying with Bordeaux mixture in Mississippi, but must be thorough and timely for successful control. (Neal). Failure to secure thorough control in Indiana was attributed to difficulty of making Bordeaux mixture stick in the fruit clusters. (Gardner).

Downy mildew caused by Plasmopara viticola (B. & C.) Berl. & de Toni

The occurrence of the disease was not reported from as many states east of the Mississippi as in the case of black rot. The prevalence was normal for the most part. Leaf infection was the most general symptom and fruit infection was reported only from New York, Tennessee, Ohio, Illinois, and Kansas.

The estimated reduction in yield for 1922 was reported by collaborators as follows: New York, .5%; Maryland, 4%; Kansas, 3%; and a trace in Illinois and Iowa.

Earliest observations on the occurrence of the disease as reported by collaborator

June 3 ..... Logan County, Ohio
June 9 ..... Clair County, Illinois
June 20 .....Clemson College, S. C.
June 22 ..... Cos Cob, Connecticut
July ..... Tompkins, New York
July 1..... Wright County, Minn.
July 7 ..... Newcastle, Dela.
July 31 ..... Oconto, Wis.
August 8 .... Crawford, Kansas

In New York the disease was found on the Delaware variety near Ithaca, and in Westchester County, Niagara and Agawam were affected while Concord in the same vineyard was healthy. (Chupp). The Fern Mandsen variety was not as susceptible as others in Kansas. (Stokdyk).

Literature

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GRAPE - Mildew, Anthracnose

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Stotz, G. J. Apercus sur l'invasion de mildiou en 1921 en Algeric. Progr. Agr. et Vitic. 77: 494-495, 540-543. May, June, 1922.

Villedieu, G. Cuivre et mildiou . Rev. Vitic. 56: 406-409. May 25, 1922.

Voglino, Pietro. Servizio di segnalazione degli attachi della Plasmopara viticola, nel 1921, nelle province di Torino, Cuneo, Novara. Nuovi Ann. Min, Agr. Italy 2: 72-80. March 1922.

Anthracnose caused by Gloeosporium ampelophagum (Pass.) Sacc.

No unusual outbreak of the disease was reported this year and was said to be of economic importance only in Maryland, South Carolina, and Arkansas. The distribution of the disease was extended to one additional state, the first occurrence being reported for Minnesota. The disease was of greater prevalence than usual in Pennsylvania, South Carolina, and Ohio. About the usual prevalence compared with the average year was reported by collaborators from Maryland, Florida, Louisiana, Arkansas, Michigan, and Kansas, while there was slightly less in Wisconsin. The following estimated reductions in yield were reported: Maryland, trace; South Carolina, 3%; and Arkansas, 1%.

Literature

Brereton, W. leGay, and C. O. Hamblin. Black spot of the vine (Gloeosporium ampelophagum). Experiments with control, 1920-21. Agr. Gaz. New South Wales 33: 432-436. June 1, 1922.

Manuel. H. L. Black spot or anthracnose. Agric. Gaz. New South Wales 32: 581-582. 1921.

Powdery mildew caused by Uncinula necator (Schw.) Burr.

No increased prevalence compared with the average year was observed. Collaborators report the occurrence of the disease from New York, Pennsylvania, Maryland, West Virginia, Arkansas, Ohio, Illinois, Wisconsin, Iowa, and Arizona. The following varietal susceptibility was observed in a vineyard in Monroe County, New York: Concords and Wordens, no infection; Catawbas, 25% infection; and 100% infection on a variety of red grape. (Chupp). Not as serious as last year in Illinois. Appeared late in the season and has caused little, if any, damage. (Anderson). The following estimated reductions in yield were reported: New York, 5 to 10%; Maryland, 1%; and Arkansas and Iowa, a trace. For the control of the disease in California, Bioletti(1) recommends the application of sulphur when young runners are out 10 or 12 inches or less (in interior valley); a second sulphuring at blooming time; and a third, if needed, when mildew threatens the fruit in midsummer. The first sulphuring should be very thorough, and the sulphur used must be very fine and free from grit. It is best to control mildew early, as summer dusting at high temperatures may produce sulphur burn of foliage.

Literature cited

1. Bioletti, F. T. Make mildew scarce. Assoc. Grow. 3(6): 7, 18. June 1922.

Fruit rots in transit

The following three tables indicate the prevalence of fruit rots occurring in transportation as reported by inspectors of the Bureau of Agricultural Economics at points of destination. No attempt is made to present the data available from inspectors where a mixture of several rots are established. The reports indicate that the most prevalent combination is that of blue mold rot with gray mold rot. Judging from the number of carloads affected, relative importance of the rots would be: blue mold rot, gray mold rot, Rhizopus rot.

Table 99. Amounts of blue mold rot in shipments of grapes as indicated by examination of cars at destination by inspectors of the Bureau of Agricultural Economics, August 7 - October 31, 1922.

Origin of shipment	No. of cars with decay	Range of percentage of decay	Origin of shipment	No. of cars with decay	Range of percentage of decay
California	65	50-100	New York	24	1-10
	59	20-45	Unknown	12	50-95
	276	1-18		10	15-30
Michigan	11	1-18		22	1-12
New York	1	60			
			Total No. cars	480	

Table 100. Amounts of gray mold rot in shipments of grapes as indicated by examination of cars at destination by inspectors of the Bureau of Agricultural Economics, July 31 - December 29, 1922.

Origin of shipment	No. of cars with decay	Range of percentage of decay	Origin of shipment	No. of cars with decay	Range of percentage of decay
California	23	50-95	North Carolina	1	2
	35	20-45	Pennsylvania	1	2
	272	1-18	Unknown	3	50-95
Michigan	4	2-12		8	20-40
New York	5	30-65		15	2-18
	5				
			Total No. cars	372	

Table 101. Showing amounts of Rhizopus rot in shipments of grape as indicated by examination of cars at destination by inspectors of the Bureau of Agricultural Economics, August 7 - December 7, 1922.

Origin of shipment	No. of cars with decay	Range of percentage of decay	Origin of shipment	No. of cars with decay	Range of percentage of decay
California	2	20-30	Unknown	1	95
	51	1-10		2	2-25
Illinois	1	3			
Michigan	2	2-90	Total No. cars	59	

Miscellaneous diseases

Crown gall caused by Bacterium tumefaciens EFS & Towns.- Reported in only a few vineyards in New York. One vineyard in Orange County with nearly every one of 200 vines affected. (Chupp). Selby states that it is frequent upon grape in Ohio, but is guarded against where grape cuttings are grown.

Dead arm caused by Cryptosporella viticola (Red.) Shear - Reported from New York, Ohio, Indiana, Michigan, and Kansas. Generally reported as only locally important.

Ripe rot caused by Melanconium fuligineum (Scrib. & Viala) Cav. - Of local importance in Delaware and observed on the Niagara and Agawam varieties, September 9. (Adams). Increased prevalence was reported for Mississippi. The rot was very severe on white grapes in many localities. The affected fruit usually hardens and hangs on the vine. (Neal). From Missouri, A. S. Rhoades of the Missouri Fruit Station reported as follows:

> "Occurring on Moore's Early and Concord despite unusually dry summer, and even in spite of thorough spraying for black rot in one vineyard."

Leaf spot caused by Cladosporium viticolum Ces. - Slightly prevalent in Louisiana. (Edgerton).

Texas root rot caused by Ozonium omnivorum Shear. - An estimated loss of 5% reported from Texas. (Taubenhaus).

Rust caused by Physopella vitis (Thüm) Arth. - The disease was reported from only one place in Florida this year. The infection was slight but the varieties showed differences in susceptibility. (Burger).

Root rot caused by Clitocybe spp. - Reported by A. S. Rhoades from Missouri: "Of great importance in low-lying or poorly drained parts of vineyards where but a few or even the majority of the vines in these parts may be affected. It is a rather slow working root rot. In badly affected vines accompanied by a drying up of the leaves and fruit and general death of the vines shortly before the ripening period."

General references

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STRAWBERRY

Frost injury

The spring freezes during the latter part of April and first part of May were quite destructive to strawberries in many of the Atlantic states, upper Ohio Valley, and Appalachian section. The earlier varieties were more generally affected. The injury resulted in killing of blooms or partial injury so that the ripened fruit was misshapen. In Bridgeville, Delaware, April 20, the Superior variety was affected to the extent of 70%, while Kellogs Premier, Success and Mascot were more resistant. (Adams).

Leaf spot caused by Mycosphaerella fragariae (Schw.) Lindau

Leaf spot is generally reported from all the important commercial strawberry producing sections. The disease, according to all reports, is apparently established wherever the host is grown. Serious losses are occasionally reported and weather conditions were particularly favorable for infection during the spring months in many of the Atlantic states. The most severe occurrences were reported from Illinois and Minnesota.

Illinois: Worse than I have ever seen it before. Probably due to the wet spring. Caused serious foliage loss in many patches. Dry weather seems to have checked it. Most growers burn old patches at this time and new patches are not suffering. (Anderson).

Minnesota: Early in June heavy infections were found on old beds but only very light infections on the new beds. At the present time leaf spot is becoming much more serious, and in many cases the leaves are so badly spotted that the vines are dying; particularly heavy infections have been found in Goodhue and Isanti Counties. (Section of Plant Pathology).

STRAWBERRY - Leaf spot, Leaf scorch

Losses were reported as follows: New York, 5%; Louisiana, 1%; Arkansas, Texas, Illinois, Wisconsin, trace; and Iowa 5%.

Table 102. Dates of first appearance, according to collaborators, 1922.

State	Date	Locality
Vermont	May 1	
Connecticut	May 26	Union
New York	June 2	Chautauqua
Delaware	June	Bridgeville
Mississippi	May 6	Lauderdale
Louisiana	January	Hammond
Ohio	May 24	Portage County
Indiana	May 9	Daviess County
Illinois	June 9	O'Fallon
Minnesota	May 27	Ramsey County
Missouri	May 19	Bloomfield

Many varieties of strawberries are being grown which show considerable resistance to the disease. Clinton reports the Lupton as very susceptible in Connecticut. The following observations were reported by Chupp in New York: Marshall and Glen Mary most susceptible varieties in Monroe County. In Chautauqua County the Dunlap and Aroma were more susceptible than the Gibson or Nick Ohmer, while infection was prevalent on the Dunlap in Chemung County. Hesler reports the Aroma as resistant and Gandy and Klondike as susceptible in Tennessee. Aroma seems to be more resistant than Klondike in Arkansas also, according to N. E. Stevens. The Klondike is not so severely injured as other varieties in Louisiana. (Edgerton). Severe injury was observed on the William Belt, and Gibson in Illinois. The disease was not serious on the Dunlap and Burrill, and the Aroma was resistant. (Anderson and Colby). Barss reports the disease as more abundant than usual in Lane County, Oregon on the New Oregon variety. Clark Seedling is reported free in the same district. In Clatsop County the Ettersburg 121 appears more affected than other common sorts.

The spraying of commercial fields is not generally practiced for the control of the disease, but collaborators report this year that growers are spraying for the disease in Mississippi and Ohio, while spraying in nurseries is conducted in Michigan.

Leaf scorch caused by Mollisia earliana (E. & E.) Sacc.

Stone (1) has recently reported on his studies of leaf scorch of the strawberry. The disease has been associated with various species of fungi, particularly in the imperfect stage. The following list of synonyms is presented: Peziza earliana E. & E., Phyllosticta potentillae Desm., Leptothyrium dryadearm Desm., Septoria potentillarum Fück., Glocosporium potentillae (Desm.) Oud., Marsonia potentillae (Desm.) Fisch., Marsonia fragariae Sacc., Ascochyta fragariae Auct., Ascochyta colorata Auct.

STRAWBERRY - Leaf scorch

It was determined that the fungus overwinters as the imperfect state on the green leaves wherever mulched. On the dry leaves there is also produced an ascigerous stage.

Marssonia fragariae was reported from Louisiana, "More common than ordinary leaf spot, not as much this year as last." (Edgerton).

Marsonia potentillae was reported for the first time as occurring in Wisconsin, according to Vaughan, who says that not all varieties were equally affected.

Ascochyta fragariae Sacc. was reported from Connecticut, where Clinton says it is severe on Glen Mary; Missouri, where it occurred locally and did not cause much damage; and New York. Regarding this fungus, Chupp says: "Dr. Stone says this is the same as his Mollisia but the spots certainly do not look anything alike, nor do the fruit bodies which I mounted."

Mollisia earliana was reported from Illinois: "Has continued to be serious on the University variety plantings on varieties introduced from Michigan. Has not been observed elsewhere in the state." (Anderson); and from Michigan: "Damage with some varieties greater than with ordinary leaf spot. Associated with Dendrophoma in one patch. Loss certainly under 1%; no control practiced in the largest area." (Coons). The leaf scorch was quite prevalent in eastern North Carolina this season, according to Wolf, who says: "The conidial stage of the organism which we have is a Marssonia rather than an Ascochyta. A survey of 150 acres near Chadbourn gives a loss of 30% or between $125 and $175 per acre this year. The disease occurred everywhere in the eastern counties, much more severely on Klondyke than Missionary, our two leading varieties. The state's crop was approximately 1000 cars, so you can see this leaf scorch cut in heavily."

Varietal susceptibility

Stone, as the result of field studies, arranges the common varieties in the following order:

Very susceptible	Moderately susceptible	Slightly susceptible
Clyde	Senator Dunlop	New Williams
Glen Mary	Ruby	Portia
Doctor Burrill	William Belt	Parson's Beauty
Pokomoke		Enhance
		Vanoise
		Joe

He says also that "control measures have not been worked out for this disease, but it is reasonable to suppose that it can be checked by using the same measures used to control leaf spot."

Literature

Cited

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STRAWBERRY - Powdery mildew, Fruit rots

Powdery mildew caused by Sphaerotheca humuli (Fr.) Burr.

Powdery mildew was considered of minor importance during the season of 1922. The protracted rainy periods during June and July in the Atlantic group of states would seem to have been favorable to the disease. However, none of the reports received from Connecticut, New York, Illinois, Washington, and Oregon indicate any increased prevalence.

Fruit rots

Rot caused by Rhizopus nigricans Ehr. The greatest loss in marketing berries is associated with the Rhizopus and Botrytis rots. Barss in Oregon reports, "Practically no rot this year, while last year it was common in western Oregon. Dry conditions have prevailed practically without interruption through the period of development and berry harvest." Mature fruit rotted badly in Ulster County, New York (E. V. Shear). Anderson reports it important only in the market in Illinois. Rhizopus rot was reported from Minnesota, but was said to be less common than Botrytis rot.

Rot caused by Pezizella lythri (Desm.) Shear and Dodge. Edgerton considers the disease is one of the most important fruit rots in the field and estimates a 3 to 5% reduction in yield for Louisiana.

Rot caused by Sclerotinia libertiana Fckl. Observed at Poplar Bluff, Missouri, causing severe damage and estimated reductions in yield of 75% locally where found. (Page).

Gray mold rot caused by Botrytis sp. Observations upon this disease were more extensive than last year. Clinton reports increased prevalence in Connecticut, where the stems and berries of the Premier variety were rotted considerably while the Chesapeake was not so seriously infected. Osmun reports the rot has been prevalent and the damage rather large in Massachusetts. Continued wet weather during the ripening season was undoubtedly responsible for the condition. Observations in Ulster County, New York show the disease is second in importance, causing estimated loss of $2,000. The green fruit, pedicels, and ripening berries affected. (E. V. Shear). In Minnesota, "The only reports of mold on strawberries were received from Ramsey County from beds in which the fruit was not picked early and was not over-ripe. In a few such cases, infection ran as high as 50%." Minnesota reported Botrytis rot as much more common than Rhizopus. In addition the disease was reported from Florida, Ohio, Illinois, and Missouri.

Literature

Stevens, N. E. Rots of early strawberries in Florida and southern California. Amer. Jour. Bot. 9: 204-211. April 1922.

Root rot (cause undetermined)

Several reports were submitted regarding root rot of strawberry plants. No data regarding the cause was given. Species of Fusarium and Rhizoctonia have been reported in past years and occasionally the crown borer or root worm is found associated, but no investigations have brought forth any consistent cause of the trouble. In some sections the problem is of increasing economic im-

portance and should receive intensive investigation. W. J. Morse of Maine had reports of plants suddenly dying in the field without any apparent cause.

In Ulster County, New York two growers sprayed strawberry plots to kill the adults of the strawberry root worms. In one of these plots a serious amount of root rot was found. (E. V. Shear). The disease was very serious in many patches in Illinois. This disease frequently causes entire patches to die out. No organism except Rhizoctonia found. No insects present. (Anderson). Hungerford in Idaho reports a root and crown rot of unknown cause from several sections, both this year and last. It was serious in Bingham County. Symptoms of the disease appear to be a general stunting and yellowing of the foliage. It causes the death of the outer leaves, and in extreme cases the entire plant succumbs.

Other diseases

Leaf spot caused by Dendrophoma obscurans (E. & E.) And. Reported abundant in southern Illinois. (Anderson). Its occurrence was also reported from Louisiana, Michigan and Missouri.

Root rot caused by Corticium vagum solani Burt. Reported especially severe om account of dry summer in Washington. (Dana).

Stem rot caused by Sclerotinia sp. Observed June 6 at LaFayette, Indiana. (Gardner).

Yellows, cause not determined. Reports from Illinois and Minnesota indicate the presence of chlorosis which has not been determined as to its infectious or non-infectious nature. Anderson in Illinois states, "We observed a similar disease on another variety. I believe I reported this under 'mosaic'. It was different from the 'yellows' observed this year in that the leaves were more curled and not so yellow." The Department of Plant Pathology reports as follows for Minnesota, "A very serious yellowing has appeared on strawberries this year. It is much more severe on some varieties than on others. It is apparently of the mosaic type, although its infectious nature has not been demonstrated. The disease is under investigation."

Nematode (Tylenchus dipsaci) Kühn) Bastian). McKay(1) has reported the following data on the distribution of the infestation on wild strawberry in Oregon.

> "During 1921 the leaf and stem-infecting nematode, Tylenchus dipsaci (Kühn) Bastian, was found on wild strawberry plants in the vicinity of Siltcoos Lake in western Lane County. During the two previous seasons this pest has been encountered on cultivated strawberries and also on clover in the same general locality. Considerable interest was, therefore, attached to the occurrence of the disease on the wild plants, and a co-operative survey was arranged with several agencies participating to determine the approximate distribution of the disease in the coast regions of the state considered most apt to show the malady. To date the disease has been found on wild strawberry plants in four counties, namely, Lincoln, Lane, Douglas, and Coos. In Lincoln County the diseased area found was very small, being only a few square yards in extent, and located a few yards from the ocean. In Lane County diseased plants were found scattered over the area about a mile in width and two miles long, all within one-half miles of the beach. The diseased plants found in Douglas County are really an extension of the infested area in Lane County and were found only a short distance over the county line. In Coos County diseased plants were found in an area extending

back one-half mile from and along the beach for two and one-half miles. In this case the limits of infestation have not been determined. The survey is being continued."

Slime mold (Fuligo sp.) In Kansas many inquiries have been received in regard to this organism. No damage reported of any consequence. (White).

Recent literature on miscellaneous diseases

Cited

1. McKay, M. B. Distribution of Tylenchus dipsaci on wild strawberry in Oregon. (Abstract) Phytopath. 12: 445-446. Sept. 1922.

Not cited

Lees, A. H. Red plant disease of strawberries. Jour. Bath, West & South Co. Soc. V, 16: 183-184. 1922.

RASPBERRY

Anthracnose caused by Plectodiscella veneta Burkholder Gloeosporium venetum Speg.

Anthracnose was apparently generally distributed in the middle western and northeastern states. It was reported from Onondaga and Chautauqua Counties, New York on the Columbia variety, and was quite severe on black caps in Chautauqua County. A loss of 2-3% was estimated for the state. (Chupp). In Ohio it is "a widely distributed trouble most common upon black caps but also affecting red raspberries and blackberries. A serious disease but probably causes less loss than cane blight, as it seems to spread more slowly." (Young). In Indiana it was reported severe in black caps. One grower in Fountain County reported a 40% loss. Estimated loss of 10% for state. (Gardner). Common and fairly severe in Michigan. (Coons). Anthracnose and crown gall associated causes dying out of many plantations in Illinois. (Anderson and Tehon). The disease was also reported from Connecticut, Pennsylvania, Delaware, Maryland, West Virginia, Arkansas, Minnesota, Iowa (8% loss), North Dakota, Kansas (5% loss), and Colorado.

Reports of successful control from Wisconsin with two sprays of lime-sulphur, a delayed dormant, 1-10 and just before bloom 1-40. (Vaughan). In Illinois controlled to some extent by two sprays. Delayed dormant and when young shoots are 6-8 inches high. (Anderson and Tehon).

Literature

Coons, G. H. Michigan raspberry diseases. Quart. Bul. Mich. Agr. Exp. Sta. 4: 138-141. May 1922.

RASPBERRY - Crown gall, Cane blight

Crown gall caused by Bacterium tumefaciens EFS & Towns.

Crown gall is one of the most important diseases on the host where it is important commercially in the East.

New York: Crown gall is a common disease of the Columbian variety in Chautauqua County. Losses in yield were very noticeable in several plantings this year due, apparently, to crown gall. (Rankin). Chupp reports the disease in six counties and estimates a 2-3% reduction in yield for New York.

Indiana: Reported severe on the Red Miller variety. (Gregory).

Illinois: Colby states that, "Crown gall is the limiting factor in red and black raspberry culture in many sections of Illinois. This disease coupled with anthracnose has put many growers out of business the last few years. These diseases are being spread still more widely by nursery stock, much of which is infected. Three percent reduction in yield is estimated in Illinois. (Anderson and Tehon).

Michigan: Coons (1) states that in Michigan "From time to time growers have called attention to serious losses brought about by crown gall. It is a typical nursery disease and diseased plants not only get worse but are infectious to other plants. Moreover soil infestation with the crown gall organism occurs and an area where the disease is introduced becomes unsafe for berries."

In addition to these reports, collaborators have reported the disease from Massachusetts, Connecticut, Delaware, West Virginia, Ohio, Wisconsin, Minnesota, Iowa, and Missouri.

Literature

Cited

1. Coons, G. H. Michigan raspberry diseases. Quart Bul. Mich. Agr. Exp. Sta. 4: 138-141. May 1922.

Cane blight caused by Leptosphaeria coniothyrium (Fckl.) Sacc.

In St. Lawrence County, New York cane blight was reported on the following varieties: Plumb Farmer, Black Caps, and Columbian Purple. In Monroe County, New York it is very serious on the black caps, causing a 5 to 10% injury, and in Chautauqua County it was very common. (Chupp).

It was generally prevalent and very serious in all parts of Ohio, affecting both the red and the black varieties, but more commonly reported upon the former. It is a serious menace to the raspberry growing industry. (Young). In Michigan Coons (1) states that, "The fungus kills whole canes by girdling, and wilted branches with dried up fruit are a familiar sight in every black-cap patch. The fungus is everywhere and gets in at every cut or scratch in the canes."

Collaborators report the disease from Massachusetts, New Jersey, West Virginia, Arkansas, Indiana, Kansas, Idaho, and Washington.

Literature

Cited

1. Coons, G. H. Michigan raspberry diseases. Quart. Bul. Mich. Agr. Exp. Sta. 4: 138-141. Illus. May 1922.

Eastern blue-stem of black raspberry (cause undetermined)

The blue-stem disease of black raspberry is known now to be widely distributed in Ohio, Michigan, New York, and Maryland, and is probably also present in most other localities where black raspberries are commercially cultivated. In addition to these states it is reported in 1922 for the first time from Connecticut (Clinton) and Illinois (Colby). Rankin reports the disease common in black and purple varieties on the Experiment Station grounds at Geneva, New York. Vaughan reports a 10% infection in one planting at Madison, Wisconsin. In Illinois Colby states that, "Eastern blue-stem as recently described by R. B. Wilcox has been found in black raspberry plantations about Peoria and bids fair to become a serious menace to the black raspberry industry there. One grower stated that he secured his plants from a Michigan nursery when the plantation was established four or five years ago."

This disease has recently been described by R. B. Wilcox. He has reported it on the following varieties of black raspberries: Hoosier, Cumberland, Plum Farmer, Kansas, Munger, Ohio, and Gregg. The Kansas seems to possess the greatest resistance. The disease has not been recognized on red raspberries, the Japanese wine-berry or on Eldorado or Erie blackberries. Several features of the disease point strongly toward the probability that it is of the mosaic type. The destruction of diseased plants and use of disease free nursery stock, set as far as practical from diseased plantations, is of importance for initial control measures.

Literature

Cited

1. Wilcox, R. B. Eastern blue-stem of the black raspberry. U. S. Dept. Agr. Dept. Circ. 227, 12 p. June 1922.

Mosaic and leaf curl, cause undetermined

Mosaic and leaf curl of the cultivated red raspberry have been reported upon by Rankin and Hockey (1) after two years spent in a preliminary investigation. A review of the literature is presented, together with descriptions of the symptoms and discussions of economic importance, dissemination, varietal susceptibility, and control measures. Dr. C. L. Shear, U. S. Department of Agriculture, considers that "The mosaic disease is probably found on red raspberries wherever they are cultivated east of the Mississippi River. It is also very common on wild plants which I have observed in Maine, New Hampshire, and New York, the past season." In New York, according to Rankin, "Mosaic is the most common and destructive disease of red raspberries in the central and eastern part of state. The disease is extremely common. The variety Perfection, universally

grown in Ulster and Orange Counties, is being abandoned. The percentage infection is so high that no attempt was made to select disease free plants of thi variety. New plantings of disease-free foundation stock of other varieties are being made this fall in these counties. Losses due to mosaic, even in young plantings, have caused a condition where the annual crop did not return the expense. In some cases the grower has lost money. Due to this condition many plantings have been plowed out in the last two years."

Reports of the disease were also received from collaborators in Vermont (loss 1-2%), Connecticut, Massachusetts, Delaware, Wisconsin, Minnesota, Idaho, Ohio, and North Dakota.

Considerable importance is attached to varietal susceptibility to mosaic. Clinton observed the disease in Connecticut mostly on the red varieties, worst on Cuthbert, also bad in Marlboro and June, while Erskine Park was little affected. E. V. Shear in New York reports the order of susceptibility as follows: Perfection, Empire, Donboro, Rochester, Constant, Cuthbert, Antwerp, Ontario, Latham, Erskine Park, Florence, and Victory. Rankin and Hockey (1) give the following list of red and purple varieties that have been found affected by mosaic: Abundance, Brighton, Brilliant, Columbian, Count, Cuthbert, Dr. Reider, Eaton, Empire, Golden Queen, Haymaker, Herbert, Highland Hardy, Idaho, June, King, Louboro, Marlative, Marlboro, Marldon, Minnetonka, Newman No. 1, Newman No. 23, Newman No. 24, Ontario, Royal Purple, Ruby, Segrist, St. Regis.

Leaf curl is reported from Connecticut for the first time and was previously confused with mosaic under yellows. (Clinton). Leaf curl, according to observations and reports, is rarely found in New York, only a few specimens having been seen. (Rankin). This disease was reported also from Maryland, Michigan, Wisconsin, and Minnesota.

Literature

Cited

1. Rankin, W. H. and J. F. Hockey. Mosaic and leaf curl (yellows) of the cultivated red raspberry. Phytopath. 12: 253-264. June 1922.

Not cited

Coons, G. H. Michigan raspberry diseases. Quart. Bul. Mich. Agr. Exp. Sta. 4: 138-141. May 1922.

Other diseases

Leaf spot caused by Mycosphaerella rubi Roark (Septoria rubi Westd.) - One of the most common leaf spot diseases of this host and generally prevalent. Collaborators have reported it from Connecticut, New York, Delaware, Ohio, Indiana, Illinois, Michigan, Minnesota, Iowa, and Colorado.

Spur blight caused by Mycosphaerella rubina (P. K.) Jacq. - Was reported from Massachusetts, New York, and Minnesota. Newhall(1) reports, "The imperfect stage of Mycosphaerella rubina (P. K.) Jacq. has been proved to be a normal part of the life cycle of this pathogene. In the latitude of southern Minnesota and New York the perithecia mature in the spring and discharge their spores by the middle of June. Mature pycnidia have been found in primary cane

lesions the last week of June and in leaf spots the first week of July. This Phoma stage plays an important role in initiating secondary cycles throughout the remainder of the growing season. The connection between the perithecial and pycnidial stages of Mycosphaerella rubina has repeatedly been demonstrated in single spore cultures on Melilotus stems. Furthermore, suspensions of ascospores inoculated into young raspberry canes likewise gave characteristic lesions in which the Phoma stage developed."

Orange rust caused by Gymnoconia interstitialis (Schlecht) Lagerh. - In most sections the disease is reported of little economic importance on this host. It was reported from New York, Ohio, Illinois, Minnesota. and California.

Powdery mildew caused by Sphaerotheca humuli (DC.) Burr. - Reported from New York and Minnesota. Rankin observed in New York what was probably this species causing a dwarfing of the tips of the green canes in several varieties of red and purple raspberries at Geneva. From 30 to 50% of the tips of the canes are affected. The leaves are very small, crumpled and often mottled. Only the conidial stage was found. The disease became evident during August.

Blue stem caused by Acrostalagmus caulophagus Lawrence - Reported from New York and Michigan. Rankin reports the disease as "common in Dutchess County and at Geneva. It seems to spread very rapidly or else the sets from diseased canes are already diseased when they are planted. From the present conditions observed and according to growers' statements, this disease has ruined the black raspberry industry in Dutchess County. Very few plantings remain." The organism was isolated by C. L. Shear during the summer from Michigan material.

Rust caused by Kuehneola uredinis (Link) Arth. (K. albida Magn.). -"This rust is very common on several varieties of red and purple raspberries at Geneva, N. Y. The older leaves are often killed. Uredinia are common on the petioles but are not found on the canes. Very little, if any, damage results." (Rankin).

Rust caused by Phragmidium imitans Arthur. - Reported from Washington.

A cane blight and a bacterial blight, not determined, were reported from Washington by Dana.

Fruit rot caused by Botrytis sp. - Reported from Connecticut and in car shipments from Washington and Michigan.

Rhizopus rot and blue mold rot, as well as gray mold rot, are often associated in the rotting of fruit in transit.

Winter injury - Reported from New York, Illinois, Iowa, and Washington. Anderson writes from Illinois, "The condition of the raspberries in the state is a matter of considerable concern. Large patches are dying out and almost all plantations show considerable injury from some cause. The plants are weak and died back during the winter. A great many of them are showing yellow leaves and whitening from the tip down. The fruit is drying up on the bushes. I feel reasonably certain that this general decline of the raspberries is due to weather conditions rather to any specific disease or group of diseases."

Literature on other raspberry diseases.

Cited

1. Newhall, A. G. The importance of the Phoma stage of Mycosphaerella rubina causing spur blight of raspberries. (Abstract). Phytopath. 13: 44-45. Jan. 1923.

Not cited

Coons, G. H. Michigan raspberry diseases. Michigan Sta. Quart. Bul. 4(4): 138-141. 1922.

RASPBERRY, BLACKBERRY - Anthracnose

Cunningham, G. H. Hypholoma rot, Hypholoma fasciculare Fr. New Zealand Jour. Agr. Jan. 20, 1922.
Rabbas. Die rutenkrankheit der himbeerstraücher. Nachrichtenbl. Deut. Pflanzenschutzd. 2: 42. June 1922.

BLACKBERRY

Anthracnose caused by Plectodiscella veneta Burkholder

This disease is not uncommon wherever the host is grown. It is generally prevalent and many growers underestimate the damage because of failing to realize the importance of all the symptoms. It caused unusual damage in Illinois. Very prevalent leaf infection on midribs, causing crinkling of leaf surface. (Anderson Tehon estimates a 3% reduction in yield for Illinois. Reported from New York (loss 1-3%), Delaware, Arkansas, Ohio, Iowa, Kansas (5% loss), and Idaho.

Crown gall caused by Bacterium tumefaciens EFS & Towns

A very serious disease in some sections but no extensive prevalence reported. Intensive surveys would, no doubt, reveal greater amounts of crown gall than realized in commercial plantings and nurseries. It is one of the limiting disease factors in Wisconsin and worse than ever in Monroe County.(Vaughan). More prevalent than reports indicate in Washington. (Dana). Prevalent in Texas, causing a 2% loss. (Taubenhaus). Important only in occasional plantings in New York. (Chupp).

Rusts caused by Gymnoconia interstitialis (Schlecht.) Lagerh. and Kunkelia nitens (Schw.) Arth.

No unusual prevalence of these rust diseases was reported by collaborators this season. They were very common on wild blackberries but not serious in the average commercial plantings. The Early Harvest was found susceptible, while the Snyder appeared most resistant in Illinois. (Anderson and Tehon).

Elliott reports a 5% loss in Arkansas. Orange rust was observed for the first time in the Salt River Valley, Arizona. (George). There has been very little of it even on the wild hosts the past two seasons in Delaware. (Adams). Collaborators also report one or both of these diseases from Massachusetts, West Virginia, New York, Ohio, Indiana, Wisconsin, Iowa, Missouri, Kansas, and Washington.

Leaf spot caused by Mycosphaerella rubi Roark (Septoria rubi Westd.)

Generally prevalent wherever host is cultivated and particularly prevalent on the wild host. A 1% loss is estimated in Texas and Illinois. Reported this year by collaborators in New York, Delaware, Louisiana, Iowa, and Arizona.

BLACKBERRY - Other diseases

Rust caused by Kuehneola uredinis Arth. Large planting at La Grange, Kentucky completely infected this fall. First appearance in the patch. Not on wild blackberry in the vicinity of patch. (Valleau). Observed locally in Illinois. (Anderson).

Leaf spot caused by Cercospora bliti. Collected at Etherton, Jackson County, Illinois, August 21, and first report for state. (Tehon).

Blue-stem caused by Acrostolagmus caulophagus Lawrence. This blue-stem disease was found in one planting in Dutchess County, New York. It kills the bushes quickly. (E. V. Shear).

Mosaic. Observed in one field in Dutchess County, New York. (E. V. Shear).

Double blossom caused by Fusarium rubi Winter. Very prevalent on dewberry and wild blackberry in Delaware. (Adams), also reported common in Louisiana. (Edgerton).

Winter injury. Reported from New York and Washington.

CURRANT

Anthracnose caused by Pseudopeziza ribis Klebahn - Generally prevalent in Ohio because of favorable weather conditions, causing premature defoliation. (Young). Prevalent in the eastern part of Massachusetts and a serious disease in some sections. (Osmun).

Cane blight caused by Botryosphaeria ribis Gross.& Duggar "Plantings showed varying amounts of the disease in Ulster County, New York but nowhere was it of much importance. Black currants and the Fay variety were most affected." (E. V. Shear). Said to be an important disease in New Jersey, West Virginia and Illinois.

Leaf spot caused by Cercospora angulata Wint. - Important in Iowa, 5% loss. (Melhus).

Leaf spot caused by Septoria ribis Desm. - Stevens County, Minnesota.

Leaf spot caused by Mycosphaerella grossulariae (Fr.) Lind. - Very prevalent in Ulster County, New York. During July many fields were entirely defoliated. (Shear). A loss of 1-3% was estimated for the crop in New York. (Chupp). Reported causing a 5% loss in Iowa. (Melhus, and prevalent in Massachusetts. (Osmun).

Chlorosis - Probably a winter injury, observed in Connecticut. (Clinton).

Root rot caused by Fomes ribis (Schw.) Gill. - Indiana. (Gardner).

Literature on currant diseases

Lees, A. H. The influence of reversion (nettle leaf) on successful black currant growing. Jour. Bath, West & South Co. Soc. V, 16: 180-182. 1922.

_____ The association of black currant mite (Eriophyes ribis) with reversion disease. Jour. Bath, West & South Co. Soc. V, 16: 237-241. 1922.

_____ Leaf character in reverted black currants. Ann. Appl. Biol. 9; 49-68. Ap. 1922.

_____ Reversion in black currants. Gard. Chron. III, 72: 65. July 1922.

GOOSEBERRY

Anthracnose caused by Pseudopeziza ribis Klebahn - The gooseberry disease in Illinois, causing defoliation early in the season. The Oregon Champion variety much more susceptible than Downing." (Colby and Anderson). "Severe outbreak according to reports in Indiana." Gardner. More on English variety than on native varieties." (Young).

Leaf spot caused by Sphaerotheca mors-uvae (Schw.) B. & C. - Illinois and Idaho.

Rust caused by Puccinia grossulariae Lagh. - This rust has a wide geographic range and apparently from the numerous reports was very prevalent this season. It is not indicated by collaborators whether the disease was on cultivated varieties of gooseberry. In Massachusetts the disease was general throughout the state and the outbreak was much more severe than previously recorded. (Osmun). Collaborators report the disease from Connecticut, New York, Minnesota, Iowa, and North Dakota.

Literature on gooseberry diseases

Garbowski, L. La Lutte contre le blanc du groseillier (Sphaerotheca mors uvae Berk. et Curt.). Bul. Soc. Mycol. France 38: 98-99. Aug. 1922.

CRANBERRY

Reports were received on cranberry diseases from collaborators only in Washington and Wisconsin. Field diseases were of the average occurrence, but fruit rots were much more prevalent apparently. General conditions of the harvested crop are reported by N. E. Stevens and H. F. Bain of the U. S. Department of Agriculture.

"Regarding the cranberry disease situation in Massachusetts and New Jersey during the year 1922, I regret to report that the losses after picking, due to fungous rots, were the worst during the last five years and, as nearly as can be learned from reliable sources, worse than any other year since 1914. One large grower in New Jersey who keeps accurate records, reported that 21% of his entire crop was lost from fungous diseases. This means 21% of the berries picked were discarded at the time the berries were sorted and packed.

"Our culture work showed 12 different fungi to be present, all of which had been previously reported on the cranberry. The two most important causes of loss in storage were Fusicoccum putrefaciens and Glomerella rufomaculans vaccinii." (Stevens).

"Fungous rots of cranberries in the Pacific Coast region during the season 1922 were of much less importance than usual, if reports of growers may be accepted for past experience. In the field there was practically no loss caused by fungi. Rosebloom, caused by Exobasidium oxycocci was fairly abundant, but apparently did not affect the yield.

"Losses in storage were greater. In individual cases as high as 50% of the berries in storage decayed by December 1. The average loss was considerably less than this, however.

"Culture studies showed that all the common eastern storage fungi

CRANBERRY

are present on the Pacific Coast. Endrot, caused by Fusicoccum putrefaciens, apparently caused at least 50% of storage loss in 1922. Sporonema oxycocci and Phomopsis rank next in order. Sclerotinia oxycocci was generally present but not serious." (Bain).

Hard rot caused by Sclerotinia oxycocci Wor. - Found at harvest time as hard rot of muddy gray colored mature berry at Mather, Wisconsin. Tip wilt form not seen this season. Has been found at Mather in previous years. (Meade). Observed producing mummies, soft rot of fruit, and blight of uprights in Washington. (Heald and Dana).

Early rot caused by Guignardia vaccinii Shear - Reported as a rot of fruit in storage, Pacific County, Washington. (Heald and Dana).

End rot caused by Fusicoccum putrefaciens Shear - Causing a rot in storage, Pacific County, Washington. (Heald and Dana).

Bitter rot caused by Glomerella cingulata vaccinii Shear - Causing a rot of fruit in storage, Pacific County, Washington. (Heald and Dana).

Red leaf spot caused by Exobasidium vaccinii (Fck.) Nor. Spotting and dropping of leaves, Pacific County, Washington. (Heald and Dana). Meade also reports it present in Wisconsin.

Rosebloom caused by Exobasidium oxycocci Rostrup - Reported killing laterals and uprights in Pacific County, Washington. (Dana).

Leaf smudge caused by Venturia compacta - Caused spotting and dropping of leaves, Pacific County, Washington. (Heald and Dana).

Storage rots caused by Sporonema sp., Pestalozzia sp., and Anthostomella destruens Shear - Reported in Pacific County, Washington. (Heald and Dana).

False blossom, cause not determined. - Reported by Meade from Wisconsin.

Blight, associated with cool nights in Wisconsin. (Meade).

Literature

Bergman, H. F. Observations on the effect of water-raking on the keeping quality of cranberries. Amer. Jour. Bot. 9: 245-252. May 1922. No.5

MULBERRY

The disease of fruit described by Siegler and Jenkins (1) as caused by Sclerotinia carunculoides n. sp. was reported from South Carolina and Texas. Ludwig states that the disease continues to turn up in Florence County, South Carolina. It destroys the entire crop of berries where it is present. Taubenhaus (2) is conducting studies in germination of sclerotia and methods of infection.

Blight caused by Cercospora sp. (probably C. moricola Cke.). Observed affecting the leaves and twigs in Florida. In one case noted, the tree was about killed. This fungus was found on the young leaves. (Burger).

Texas root rot caused by Ozonium omnivorum Shear - Prevalent in Texas and causing a 10% loss. (Taubenhaus).

Literature cited

1. Siegler, E. A. and A. E. Jenkins. A new Sclerotinia on mulberry. Science, n. ser. 55: 353-354. 1922.

DISEASES OF SUB-TROPICAL FRUITS

CITRUS FRUITS

Frost injury

The January freeze in California caused serious loss to citrus. Brown (Bur. Mark. & Crop Est. Div. Letter 3: 31. Febr. 2, 1922) states:

> "It seems practically certain that the damage to oranges and lemons will be at least 25 to 50% of the crop. The lowest temperatures were encountered along the Foothills Boulevard at Redlands, San Dimas, and Pomona, and the least damage occurred at Corona and Riverside.
>
> "Growers and shippers held a meeting Saturday afternoon, January 21, and agreed not to pick, pack, or ship any oranges from Los Angeles County until February 6. Other counties took similar action, but I understand that a few cars were shipped out of Riverside which were picked since the frost; so the inspectors will do well to be on the lookout for frost injury in California oranges."

Kaufman (1), Agricultural Statistician of the California co-operative crop reporting service, states that the loss of oranges by the January freezes amounted to 16,000 cars or 7,200,000 boxes. The orange crop estimate as of May 1, 1922, is 78% of normal compared with 92% last year. The lemon crop is estimated at 66% of a normal crop, compared with 90% last year.

Investigations on the prevention of frost damage in California were reported in the United States Department of Agriculture Official Record, Jan. 4, 192

> "During the present frost season in southern California investigations are being conducted and temperature surveys made by the Weather Bureau, under the direction of Floyd D. Young, in the vicinity of Pomona, San Bernardino, and Corona. These investigations intimately concern the question of artificial heating of orchards, not only in California but in other districts as well. That such work is appreciated by the local growers is evidenced by their hearty co-operation. The season during which there is danger of frost advances progressively northward, and it is planned to utilize the force now in the vicinities above mentioned in more northern districts during the latter part of the season.
>
> "In the work conducted last year a number of interesting facts were developed. Perhaps the most interesting were found in the vicinity of Pomona, where very marked inversions of temperature were observed. In one instance the temperature 40 feet above the ground was 15° higher than at the surface. It appears that conditions of this kind are most marked in the smaller valleys which are more or less inclosed by hills. Results obtained by such investigations become of special value in their application to heating methods employed for protecting growing fruit. The heat from the fire is nearly all expended in raising the temperature of the air within the 40-foot layer. In other words, the warmer upper air acts as a roof, which stops the ascent of the heated air.
>
> "The experience of some growers shows that the temperature of an orchard may be raised as much as 5° or 6° on the average with an amount of firing that will not entail a prohibitive expense, and it has been

demonstrated that firing in certain localities at least is an economic and practical business proposition."

Literature

Cited

1. Kaufman, E. E. Frost injury. California Citrograph 7: 262. June 1922.

Not cited

Anonymous. (Editorial) The California freeze. Citrus Industry 3(2): 13. Febr. 1922.

_____ Handling of frozen trees and fruit discussed by lemon men. California Citrograph 7: 148-149, 178.

_____ Effect of cold wave of 1922 compared with that of 1913. California Citrograph 7: 138, 172-173. March 1922.

Canker caused by Bacterium citri (Hasse) Jehle

An outbreak of citrus canker was discovered May 20, 1922, in a grapefruit orchard in an isolated section near Davie, Florida. As soon as specimens of the infected leaves were received at Gainesville, the State Plant Board force and department co-operators were sent to the spot and arrangement made for destroying the diseased grove. A corps of 25 experienced canker men were sent by the Florida Plant Board, with equipment for uprooting and burning all the infected trees. Infection was found on eight properties in the locality.

The following statement (2) indicates the progress during the year in the eradication in the vicinity of Davie:

"The outbreak of canker that took place in Broward County in June is under control and the cankered trees are being burned as fast as found. In May 585 trees were found to be infected and were destroyed, in June - 168, July - 28, and August - 34. Nine properties are affected and are under strict quarantine."

In addition to the outbreak of the disease in Florida, observations show a serious increased prevalence in Louisiana. In the southern part of the state citrus canker has spread very rapidly this season as there have been insufficient funds for eradication work. (Edgerton). This situation is of special importance particularly to the citrus industry and eradication work in Mississippi and Florida. In Mississippi, Miles reports that an infection was found at Agricola, George County. The tree was destroyed and no additional infection was found furing intensive scouting of the surrounding territory.

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du Toit, P. J. Annual report of the Secretary for Agriculture, year ended 30th June, 1922. Jour. Dept. Agr. South Africa 5: 480-517. Dec. 1922.

Scab (causal fungus not yet determined)

The results of several years investigation of citrus scab, particularly under Florida conditions, has been published by J. R. Winston (1) . This disease is second in importance to melanose and stem-end rot caused by Phomopsis citri, is of foreign introduction and attacks many citrus species. It occurs in India, China, Formosa, Japan, Hawaii, Paraguay, Brazil, Canal Zone, Yucatan, West Indies, Canary Islands, South Africa, and the citrus growing regions of the Gulf States, but as yet it has not become established in California or Arizona.

Florida: In Groves - Citrus scab has not been serious for several years due to dry weather prevailing during periods of infection in March and April. Perhaps less prevalent on spring bloom fruit than in 1921. Quite prevalent on summer bloom fruit every year. Very little spraying was needed for control.

In Nurseries - Scab continues to be the most serious nursery disease. At least as prevalent as in 1921. Scab on the most susceptible varieties can be controlled commercially by applications of Bordeaux-oil emulsion about once a month. (J. R. Winston).

Prevalent on grapefruit, Satsuma oranges, rough lemon and sour orange stock. It is very common in the nurseries affecting the stock. This spring (1922) was hot and dry, so very little scab showed up. However, during the latter part of May and the first of June when the summer rains began it became serious. During the rainy season the temperature at night is rather low, falling down to 65° to 68° F. It seems therefore that scab is correlated with low temperature and high humidity as recently pointed out by Fawcett. (Burger).

Louisiana: Very common; high percentage of injury and considerable loss on Satsumas. First report April 26. (Edgerton).

Varietal susceptibility among the commercial species and varieties grown under Florida conditions is reported by Winston (1) as follows:

Extremely susceptible - sour orange (Citrus aurantium), lemon (C. limonia), calamondin (C. mitis), and tangelo (a tangerine-grapefruit hybrid)

Quite susceptible - grapefruit and shaddock (C. grandis); the King orange, tangerine, mandarin orange and Satsuma orange, all of the kid-glove group of oranges (C. nobilis), and the citrange (a hybrid of Poncirus trifoliata and the tangerine)

Rarely attacked - sweet or round oranges (C. sinensis), and kumquats (Fortunella spp.)

Apparently immune - Mexican or Key lime (C. aurantifolia), and the Royal and Triumph grapefruits (supposed to be hybrids of the orange and grapefruit)

Regarding the susceptibility of varieties of grapefruit, which is "the commercial type of citrus most affected by scab in Florida," Winston states that

"Such grapefruit varieties as the Duncan, Walters, Pernambuco, Leonardi, and Foster are susceptible to infection in about equal degree. Hall (Silver Cluster) is much more susceptible and the Marsh considerably less so than the above varieties, and these two can frequently be recognized in mixed plantings simply by the relative proportion of scab present. The Royal and Triumph varieties have never been observed by the writer to be infected."

Commercial control is secured with timely applications of plain Bordeaux mixture as well as Bordeaux mixture plus oil emulsion either in the nursery or in the orchard.

Literature

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Also in Flor. Grow. 25(7): 5, 26. Feb. 18, 1922.

Melanose caused by Phomopsis citri Fawcett

J. R. Winston of the Office of Fruit Disease Investigations makes the following statement on melanose in Florida.

"Melanose is gradually becoming established in the groves which

are getting around twelve or fifteen years of age, particularly up and down the rich country in Florida. It seems that this disease does not amount to much before trees are twelve or fifteen years old, when dead wood becomes a considerable factor. Then melanose usually sets in irrespective of the locality in which the trees are growing. The disease was probably 10% more widespread and 15 to 20% more serious than in 1921. The twigs killed back by drought in March and April and dead fruit proved to be fertile sources of infection later. First infections of consequence occurred when the rains set in in May. Infection on spring bloom fruit much more serious than on crop from summer bloom. Gross financial loss was from 10 to 15% more than in 1921."

According to Burger very little melanose showed up this spring in Florida. However, when the rains began the June fruit and the June flush of growth were badly affected with the disease. He has recently made a preliminary report on melanose and stem end rot of citrus fruits (1).

Literature

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Winston, J. R. and J. J. Bowman. Commercial control of citrus melanose. U. S. Dept. Agr. Dept. Circ. 259: 1-8. Mar. 1923.

Stem end rot caused by Phomopsis citri Fawcett and Diplodia natalensis Ev.

J. R. Winston gives the following account of stem end rot in 1922 in Florida:

"Stem end rot is becoming more generally distributed throughout the citrus growing section of Florida. It occurs in all sections where melanose is found in quantity and in some localities where melanose is not prevalent. Stem end rot is becoming more serious annually. At least 60% of the citrus fruit crop is infected potentially with one or the other of these fungi.

"Bordeaux oil emulsion applied at the proper times seems to reduce stem end rot.

"Shipping fruit pre-cooled or under refrigeration is becoming more popular, resulting in appreciably less decay than would occur if fruit were shipped without being chilled.

"Gross loss from the disease in 1922 about the same as in 1921."

CITRUS - Fruit rot, Withertip, Anthracnose, Blast

Fruit rot caused by Phomopsis californica Fawcett

A new disease recently described by Fawcett (1) in California has been found on fruit of lemons causing decay, and in the bark of lemon trees affected with shell bark. The decay is of very slow development. The fungus has probably occurred in California for a long time, but has been overlooked because of its slight importance in causing decay of the fruit.

Literature

1. Fawcett, H. S. A new Phomopsis of citrus in California. Phytopath. 12: 419-424. Sept. 1922.

Anthracnose and wither-tip attributed to Colletotrichum gloeosporioides Penz.

Burger reports that in Florida wither-tip "was severe last spring. During the fall there was a severe storm lasting several days and it is the opinion of many growers that the wither-tip was caused primarily by the storm. This disease was also reported from several nurseries during the summer before the storm." J. R. Winston states that wither-tip was about 10% more prevalent than in 1921, while anthracnose, which occurs for the most part on grapefruit, was about the same. The following comment on the disease appeared in the California Citrograph 7: 226. May 1922:

> "Wither-tip, a disease of citrus trees, which has been more or less prevalent in Florida and Cuba, but which is seldom of any commercial importance in California, is more common this season in this state than for many years."

Blue mold rot caused by Penicillium spp.

Winston reports that blue mold rot in general has been considerably more prevalent than in 1921, particularly so during the fall of 1922 in Florida.

Blast caused by Bacterium citriputeale C. O. Sm.

A. L. Chaffin states that "in California citrus blast, a new disease of citrus fruit, has cut our yields in half during the past six years." The following account of the outbreak of citrus blast in southern California is by J. E. Coit (California Citrograph 7: 242. May, 1922).

> "Very recently the writer discovered the citrus blast disease on orange trees in the foothills near Pasadena. Further investigation showed that the disease was fairly well distributed through a belt including groves at the higher elevations from Sierra Madre westward as far as the Devil's Gate region.
>
> "It has been most serious in the northern counties, particularly in Butte, Tehama, and Sacramento. This present case is the first to be reported south of the Tehatchepi.....

"The bacteria develop and spread during cool, rainy weather and it is interesting to note that the present outbreak seems to be confined chiefly to localities where the rainfall during the past winter has been in the neighborhood of thirty inches, and where frequent showers have been the rule for the past few weeks. This similarity of winter climatic conditions between the Altadena-Sierra Madre section and Butte County is believed to be largely accountable for the present outbreak. Whether the disease will cause serious damage will no doubt depend on weather conditions during April. With dry, warm weather the disease may tend to disappear, but with frequent showers, defoliation of the trees and serious killing back of the twigs may result."

Foot rot ,cause not reported

"Foot rot was reported as serious in several old groves as well as nurseries in Florida. From one nursery specimens were collected and the fungus Phytophthora terrestria Sherb. was isolated. In the nursery it occurred during the rainy season and in that part where the soil was poorly drained." Burger. Winston considers it about as prevalent as in 1921 in Florida and says that "it occurs for the most part on old seedling sweet orange, but is not uncommon on budded trees on a susceptible root."

Blossom-end rot associated with several fungi

Winston states that the blossom-end rot was "more prevalent during the fall of 1922 than for several years in Florida. It occurred principally on the Navel, Blood, and Pineapple orange varieties in the central part of the state. Satisfactory preventive or control measures not known."

Miscellaneous parasitic diseases

Scaly bark and nailhead rust attributed to Cladosporium herbarum var. citricolum Fawcett. Florida - "On the west coast scaly bark seems to be worse. However, it was reported from other districts and the nursery inspectors have reported it from several nurseries."(Burger). "Nailhead rust prevalent in about the same degree as in 1921. Of minor importance." (Winston).

Psorosis (cause undetermined) - "Common on sweet oranges and tangerines. Occurs on other species in Florida also." (Winston). Fawcett recently reported on studies of the disease in California(2) and George reports a similar disease from Arizona on orange and grapefruit.

Brown rot gummosis caused by Pythiacystis citrophthora Sm. & Sm. Arizona - "Found frequently on grapefruit where cultural practices are careless. It is common on stems of orange trees, never observed on fruit."(George). (See also reference (2)).

Gummosis, cause undetermined. Florida - "Especially severe on lemons, but occurs to a limited extent in other species. Prevalent on about the same degree as in 1921. Treatments unsuccessful." (Winston). Burger states that "Gummosis was reported from many old groves in the state. Cultures were made of the material sent in and two fungi were isolated, Phomopsis citri Fawcett and Diplodia sp."

CITRUS - Miscellaneous diseases

Lime wither-tip caused by Gloeosporium limetticolum Clausen. - "Considerably less prevalent on fruit in Florida than in former years, due to exceedingly dry weather while fruit was in a susceptible condition. The twig blight form quite prevalent during the summer and fall months." (Winston).

Septobasidium pedicillatum (Schev.) Pat. - "Slightly more prevalent than in 1921. This or a very similar organism is reported to be killing twigs in certain sections of the central part of the state, but I have not seen such a case." (Winston).

Die-back, cause not determined. - Florida "A very serious disease. The specimens came from old as well as young trees. It was also found in the nurseries." (Burger). "About 10% more widespread and about 10% more serious than in 1921, particularly 'ammoniation.' Bluestone spplied as a fertilizer usually acts as a corrective." (Winston).

Damping off, cause not determined. Florida - "This trouble was reported from several citrus seed beds where they had kept the soil too wet. After the amount of water was controlled the disease disappeared." (Burger).

Blight, cause unknown, was reported serious in Florida. - "Along the East Coast the disease seems to be serious. The growers, while losing one to two percent of their trees annually, have become so accustomed to the disease that they think little of the seriousness of it. From all quarters of the state reports continually come in showing that blight is present and growers are sustaining a constant loss from this disease. The blight does not attack the young trees but takes trees after they come into bearing." (Burger).

Sooty mold caused by Meliola sp.- Generally prevalent in Louisiana. (Edgerton).

Miscellaneous non-parasitic diseases and injuries

Mottle leaf, undetermined. - "Much more prevalent than in 1921 in Florida. Deep and excessive cultivation seems to induce chlorosis in dry seasons. Many cases apparently due to excess lime in soil or soil unfit for citrus culture." (Winston).

Spray injury. - "Oil burn much more prevalent in Florida than in former years, degree of injury ranging from slight to severe. Sulphur sunburn somewhat more prevalent than in former years, degree of injury about the same as in 1921. Injury following the applications of Bordeaux-oil emulsion reported from many sections of the state. For the most part this was not of special importance. It seemed to be more of an oil burn rather than Bordeaux injury." (Winston).

"Star melanose, apparently a form of Bordeaux injury, has been observed in many groves only on trees sprayed with Bordeaux mixture. On leaves for most part. Damage negligible." (Winston).

Recent literature on miscellaneous citrus diseases

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Carrol, R. A. Cutting grooves on lemon tree trunks to control gum diseases. Calif. Citrogr. 8: 48. Dec. 1922.

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Hamblin, C. O. Control of "collar rot" of citrus trees. Agr. Gaz. New South Wales 33: 294-296. Apr. 1922
Fusarium limoni.

Hardy, F. Studies in West Indian soils. II. The soils of Montserrat, their natural history and chief physical properties, and the relationship of these to the problem of die-back of lime trees. West Indian Bul. 19: 189-213. March 31, 1922.

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Horne, W. T. A Phomopsis in grapefruit from the Isle of Pines, W. I., with notes on Diplodia natalensis. Phytopath. 12: 414-418. Sept. 1922.

O'Byrne, F. M. Bordeaux-oil emulsion. Quart. Bul. State Plant Bd. Florida 6: 46-58. Jan. 1922.

Reinking, O. A. and G. W. Groff. The Kao Pan seedless Siamese pummelo and its culture. Philipp. Jour. Sci. 19: 389-437. Oct. 1921.
Very susceptible to diseases, especially canker.

Reed, H. S. Observations on the citrus industry in Mexico. California Citrogr. 7: 140. March 1922.

Samuel, Geoffrey. Brown rot of citrus fruit, its occurrence in South Australia on oranges. Jour. Dept. Agr. Sc. Austr. 26: 112-118. Sept. 1922.
First found August 1922, probably present for some years. Probably will not become important as weather conditions usually unfavorable.

Winston, J. R. and W. W. Yothers. Bordeaux oil emulsion spray. Citrus Ind. 3 (1): 14-15. Jan. 1922.

FIG

Rust caused by Physopella fici (Cast.) Arth.

In 1907 Arthur (North American Flora) reported the distribution of this rust from South Carolina to Texas; including at that time the following states: South Carolina, Florida, Alabama, Mississippi. Louisiana, and Texas. In figure

103 the present known distribution of the rust is indicated. The disease was reported this year from Florida, Louisiana, and Texas. Trees were defoliated because of the disease, but not resulting in any apparent injury in Louisiana. (Edgerton). Burger states that the disease was very common this season in Florida.

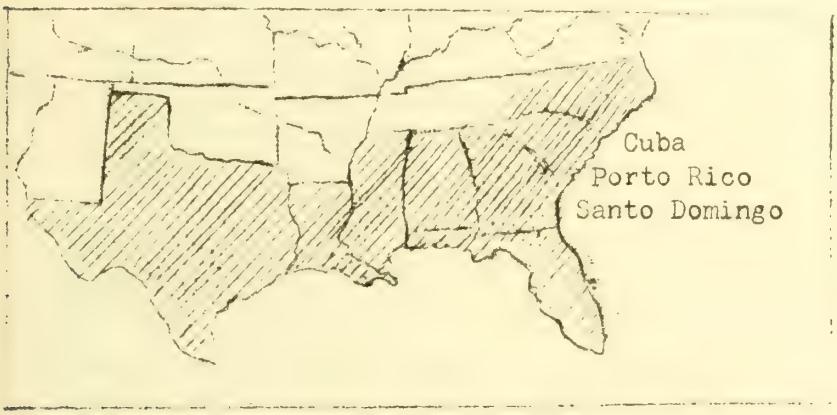

Fig. 103. Showing present known distribution of fig rust caused by Physopella fici.

Black smut caused by Aspergillus niger v. Tiegh.

Reported on figs in market in Washington. (Dana). Smith and Phillipps (1) have recently reported their investigations on this disease.

Literature

Cited

1. Smith, Elizabeth H., and Edith H. Phillips. Fig smut studies. (Abstract) Phytopath. 12: 442. Sept. 1922.

Not cited

Smith, E. H. and E. H. Phillips. Studies of the so-called "smut" of white fig varieties. Mo. Bul. Calif. St. Dept. Agr. 11: 755-758. Oct. 1922.

Other diseases

Anthracnose caused by Glomerella cingulata (Stonem.) S. & von S. Locally important in Jackson and Harrison Counties. Mississippi. (Meade).

Leaf spot, probably caused by Cercospora bolleana (Thüm.) Sacc. Reported from South Carolina and Texas.

Leaf blight caused by Rhizoctonia microsclerotia Matz. Quite prevalent in Florida and in some places caused considerable damage. (Burger). Taubenhaus reports the disease was found for the first time in Friendswood, Texas, in 1919. "The disease was first described by Matz and found by him in Florida. This trouble has been found for the first time by the writer at Friendswood, Texas, in 1919. The disease first appeared on the tree and in a short interval has practically affected every tree in that orchard which consisted of over fifty trees.

Experiments in spraying with Bordeaux mixture 4-4-50 seemed to effect perfect control."

Limb blight caused by Corticium lactum (Karst.) Bres. Reported from Mississippi, Florida, and Louisiana. In Florida the disease was quite prevalent. Several specimens have been sent in to the office indicating that the disease exists all over the state. (Burger).

Canker caused by Macrophoma fici Alm. & S. Reported from Texas by Taubenhaus.

Canker caused by Tubercularia fici. Reported locally severe in Louisiana. (Edgerton).

Canker caused by Diplodia sycina Mont. var. syconophila Sacc. Taubenhaus in Texas reports on the disease as follows: "A serious limb canker of the fig was found to be very prevalent during the years of 1919-1920, and 1921. The organism is readily isolated, grown in pure culture, and artificial inoculations carried out, and the disease reproduced. The causal organism corresponds to Diplodia sycina Mont. var. syconophila Sacc. mentioned by Heald and Wolf. The Diplodia canker is distinct and different from the one caused by Macrophoma fici, Tubercularia fici, Corticium lactum, Botrytis cinerea, and Sclerotinia libertiana."

Root knot caused by Heterodera sp. "In Arizona root knot on young fig trees was reported to this laboratory for the first time this year, although D. C. George states that the trouble has been prevalent in the Salt River Valley for some time. Specimens sent in came from the vicinity of Phoenix."(Brown).

DATE

Leaf spot caused by Graphiola phoenicis (Mong.) Poit. Reported from Texas and Arizona. Taubenhaus reports that "the two varieties most susceptible are Phoenix dactilifera and Phoenix canariensis. In pure culture it resembles yeast colonies. Successful inoculations were only obtained on young tender foliage.

Leaf spot caused by Exosporium palmivorum Sacc. Reported prevalent but unimportant in Texas. (Taubenhaus).

AVOCADO

Black spot caused by Colletotrichum gloeosporioides Penz. Reported prevalent on leaf and fruit in Florida. The leaves affected with the disease are brownish-yellow at the tip. (Burger). Winston states it was more prevalent than in 1921 in Florida and favored by the exceptionally wet fall.

Scab. In Florida, Burger states, "This disease is caused by a fungus which cannot be distinguished morphologically from the fungus causing citrus scab. The fungus causing citrus scab has gone under the name of Cladosporium citri Mass. This fungus is not a Cladosporium, but, on account of the inability to produce good fruiting bodies, it has has not been able to be classified. Some diseased leaves were sent in which were badly infected with Pestalozzia sp."

Literature

Stevens, H. E. Avocado diseases. Florida Agr. Exp. Sta. Bul. 161 3-23. 1922.

OLIVE

Literature

Kinman, C. F. Olive growing in the southwestern United States. U. S. Dept. Agr. Farmers' Bul. 1249. p. 43. 1922.

Smith, C. O. Pathogenicity of the olive knot organism on hosts related to the olive. Phytopath. 12: 271-278. June 1922.

MANGO

Stem end rot caused by Diplodia natalensis Ev. Somewhat less prevalent than in 1921 in Florida. (Winston).

Tear stain caused by Colletotrichum gloeosporioides Penz. was very prevalent in unsprayed groves while anthracnose and blossom blight were less prevalent than in 1921. (Winston).

Die-back, cause not determined, Florida - Symptoms show die-back of young twigs similar in appearance to the die-back of citrus. (Burger).

Bloom drop, cause unknown. Burger reports, "There were many inquiries concerning the means to prevent the bloom from dropping. Specimens were sent into the laboratory but no one fungus could be found which was thought to be responsible for this. It is believed that it is a physiological trouble."

Literature

Averna Sacca, Rosario. Macrophoma sp. Bol. Agr. Sao Paulo 23: 82-84. Mr./Ap. 1922.

PERSIMMON

Leaf spots associated with Phyllosticta sp. and Alternaria sp. - Reported from Florida. (Burger).

Rot caused by Rhizopus sp. Taubenhaus reports in Texas that, "Japanese persimmons frequently rot on trees in the orchards due to Rhizopus nigricans. This disease is quite common during wet weather and may result in a total loss of the fruit on the tree. Artificial infections may be readily obtained by introducing spores of the fungus into punctures made in the healthy fruit on the trees."

GUAVA

Anthracnose caused by Gloeosporium psidii. This disease was reported from several sections in Florida. In some places considerable loss was sustained. (Burger).

Soft rot caused by Rhizopus sp. was found on shipped guavas during the the past summer in Florida. (Burger).

LOQUAT

Scab caused by Fusicladium dendriticum (Wolbr.) Fcl. var. eriobotryae Scabia. Prevalent in Florida but damage is not very great. (Burger).

Blight caused by Bacillus amylovorus (Burr.) Trev. Many places in Florida have this most serious of all diseases of this tree. The blight was reported from several localities. (Burger).

Literature

Anonymous. Fruit tree diseases and their treatment. So. African Fruit Grow. 9: 325, 327, 329. Nov., Dec., 1922. Scab or Fusicladium of the loquat; leaf-blight of the loquat.

Putterill, V. A. Plant diseases in the Western province. IV. Jour. Dept. Agr. So. Africa 4: 332-337. Apr. 1922. Two diseases of the loquat (Fusicladium or scab; Entomosporium blight).

BANANA

Literature

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Zeman, V. Bacteriosis del bananero. Bol. Camara Agr. Costa Rica 2: 23-32. Feb. 1922.

POMEGRANATE

Literature

Averna Sacca, Rosario. Megalenectria coespitosa Speg. Bol. Agr. Sao Paulo 23: 79-82. Mr./Ap. 1922.

AVERRHOA CARAMBOLA

Literature

Welles, Colin G. Cercospora leaf spot of Averrhoa carambola. Philipp. Jour. Sci. 19: 747-751. pl. 1-2. Dec. 1921.

DISEASES OF NUTS

PECAN

Scab caused by Fusicladium effusum Wint.

Scab was generally reported in the Gulf states. It was not very severe this season in South Carolina where Ludwig estimated a 2% loss. In Georgia it was not so bad as the last two years. (Bullard). In Florida it was one of the commonest diseases of the pecan. (Burger). Neal reports that, "Scab was serious again this season along the Gulf Coast, in the Delta counties, and in many localities in the central eastern part of Mississippi. In many groves where susceptible varieties are planted, the crop was a total failure as a result of scab. A number of the large growers in the state are equipping themselves with power sprayers, and are spraying for scab control." In Louisiana it was common and the cause of considerable loss in some varieties. (Edgerton). It was said to be very prevalent in Texas, and was reported from Arkansas.

Wight reports the following varieties especially susceptible in Georgia: Georgia Giant, San Saba, Delmas, and Van Deman. In Mississippi Neal reports the Delmas, Pabst, and Schley as susceptible. The Stuart, Tocho, Frotscher, Russell, and Moneymaker are resistant. Success is reported as scabbing in some localities.

Demaree (1) reports that while work on scab control experiments in 1922 has not progressed far enough yet to formulate a standard spray schedule, the results obtained so far indicate that spraying for scab on susceptible varieties is profitable. In some cases unsatisfactory control is due to the fact that spraying is not attempted until scab has become thoroughly established in the orchard; if spraying is continued for several years until the number of sources of infection is reduced, results will be probably entirely satisfactory. Bordeaux mixture has been found to be the most effective spray yet used as a scab preventive, but because of the danger of foliage injury, after the disease is once under control its use may be limited at least to the first two applications, which are the most important ones, and lime-sulphur solution substituted for the later ones. Bordeaux 4-6-50 was more effective than 3-6-50 and caused no more foliage injury.

The cumulative benefit of spraying is due to the fact that it prevents the formation of the spots on the twigs in which the pecan scab fungus mainly hibernates during the winter, and thus largely eliminates the sources of initial spring infection.

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PECAN - Rosette, Other diseases

Rosette (cause undetermined)

Rosette was said to be generally distributed in South Carolina, where two instances of considerable damage occurred. A 3% loss was estimated by Ludwig. Neal reports the disease as becoming common in many of the southern counties in Mississippi. Collaborators also report rosette from Georgia and Florida. Several publications have appeared recently discussing the cause of the disease.

Literature

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Weaver, Walter. Pecan rosette. Proc. Nat. Nut. Grow. Assoc. 20(1921): 67-72. 1922.

Other diseases

Powdery mildew caused by Microsphaera alni (Wal.) Salm. - Reported from South Carolina and Florida.

Crown gall caused by Bacterium tumefaciens EFS & Towns. - Taubenhaus states, "As a rule the pecan is not subject to crown gall, at least judging from the scarcity of specimens received of this disease. However, in one instance, some fifteen trees in one orchard growing in the same row were all found to have suddenly died, and when pulled out, showed typical crown gall.

Brown leaf spot caused by Cercospora fusca Rand. Two reports in South Carolina. (Ludwig).

Anthracnose caused by Glomerella cingulata (Stonem) S. & Von S. Prevalent in some sections in small amounts, Florida. (Burger).

Hypochnus sp. associated with a disease affecting pecans near Bluefield, Florida. There was slight damage this past season. (Burger).

Black pit cause unknown. Increased prevalence reported in Mississippi and causing a 20% loss. "Black-pit, a disease, an apparently physiological trouble, was very destructive all over Mississippi the past season. After the nuts attained considerable size the husk tissues became black and somewhat pitted, and finally resulted in heavy shedding. Demaree attributes this condition to dry weather the year previous, but although possible, this theory is uncertain." (Neal).

Nursery leaf blight caused by Phyllosticta caryae Peck. Common in many nurseries but not serious in Mississippi. (Neal).

PECAN, WALNUT, ALMOND

Literature

Demaree, J. B. Pecan kernel spot and its relation to insect punctures. Proc. Georgia-Florida Pecan Grow. Assoc. 1922. 4-7. 1922.

_____ Kernel spot of the pecan and its cause. U. S. Dept. Agr. Bul. 1102. 15 p. Sept. 1922.

Demaree, J. B. Pecan disease investigations during 1921. Proc. Nat. Nut Grow. Assoc. 20 (1921): 37-39. (1922).

Miles, L. E. A new species of Myriangium on pecan. Mycologia 14: 77-80. March 1922.

Reed, C. A. Pecan varieties. Proc. Nat. Nut. Grow. Assoc. 20 (1921): 88-97. (1922).

WALNUT

Blight caused by Bacterium juglandis (Pierce). EFS. - "Prevalent in the Willamette Valley, Oregon, but less severe than last year, although some individual trees are going to lose all their nuts due to insect-borne infections. Rain infections appear to be far less than usual because rains ceased before much walnut foliage was out." (Barss). Fromme reported its occurrence in Virginia.

Canker caused by Nectria sp. - Associated with winter injury in Orleans County, New York. (Chupp).

Literature

Batchelor, L. D. Winter injury to young walnut trees during 1921-22. California Agr. Exp. Sta. Circ. 234:1-5. 1922.
Also in Month. Bul. Dept. Agr. Calif. 11: 445-449. May/June, 1922.

ALMOND

Crown gall caused by Bacterium tumefaciens EFS. & Towns - Maricopa and Gila Counties, Arizona; common, injury less than 1%. (Brown).

Root knot caused by Heterodera radicicola (Greef) Müll. - Common in Maricopa County, Arizona. (George).

Literature

Taylor, R. H. The almond in Calofornia. Calif. Agr. Exp. Sta. Bul. 297, Rev. ed. 84 p. March 1921.

COCONUT

Ashby, S. F. Experiments on red ring disease of the coconut in Grenada. Agr. News 21: 94-95. March 18, 1922.

Catoni, L. A. Una enfermedad del cocotero. La Hacienda 17: 362-363. Dec. 1922.

Cobb, N. A. Red ring in Panama. U. S. Dept. Agr. Official Record 1 (7): 1, 8. Feb 15, 1922.

Fulton, H. R. Occurrence of Thielaviopsis paradoxa on the coconut palm in Florida. Phytopath. 12: 398-399. Aug. 1922.

La Rue, Carl D. and H. H. Bartlett. A demonstration of numerous distinct strains within the nominal species Pestalozzia guepini Desm. Amer. Jour. Bot. 9: 79-92. Feb. 1922.

Petch, Thomas. Report of the mycological division (Ceylon Dept. of Agriculture) 1921. Trop. Agr. 58: 214-216. Ap. 1922.

Sharples, A. and J. Lambourne. Observations in Malaya on bud rot of coconuts. Ann. Botany 36: 55-70. 1922.

Sundararaman, S. The coconut bleeding disease. Bull. Agr. Res. Inst. Pusa No. 127, 3 p. 1922.

THE PLANT DISEASE BULLETIN

Issued By

THE PLANT DISEASE SURVEY

Supplement 29

Diseases of Forest and Shade Trees, Ornamental and Miscellaneous Plants In the United States in 1922

August 1, 1923

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

PLANT DISEASE SURVEY

1922

List of collaborators of the Plant Disease Survey who have made the principal contribution to the 1922 annual summary.

It should be understood that many other collaborators and pathologists have assisted in gathering data within the States but the following list include those who actually furnished state reports to the Washington office.

Alabama	W. A. Gardner
Arizona	J. G. Brown
	D. C. George
Arkansas	J. A. Elliott
California	J. T. Barrett
	W. T. Horne
	W. S. Fields
Colorado	C. D. Learn
	Ellsworth Bethel
Connecticut	G. P. Clinton
Delaware	J. F. Adams
Florida	O. F. Burger
Georgia	T. H. McHatton
Idaho	C. W. Hungerford
	Henry Schmitz
Illinois	H. W. Anderson
	L. R. Tehon
Indiana	M. W. Gardner
Iowa	I. E. Melhus
Kansas	L. E. Melchers
	R. F. White
Kentucky	W. D. Valleau
Louisiana	C. W. Edgerton
Maine	W. J. Morse
Maryland	C. E. Temple
	R. A. Jehle
Massachusetts ...	A. V. Osmun
	P. J. Anderson
Michigan	G. H. Coons
Minnesota	Sect. Plant Path.
Mississippi	D. C. Neal
Missouri	E. F. Hopkins
Montana	H. M. Jennison
	D. B. Swingle
	W. N. Christopher
Nebraska	R. W. Goss
Nevada	C. W. Lantz
New Hampshire ...	O. Butler
New Jersey	M. T. Cook.
New York	Charles Chupp
	L. M. Massey
	R. S. Kirby
North Carolina ..	L. E. Yocum
	A. C. Foster
North Dakota	H. L. Bolley
	Wanda Weinger
Ohio	A. D. Selby
	R. C. Thomas
	Freda Detmers
Oklahoma	Robert Stratton
Oregon	H. P. Barss
	S. M. Zeller
	C. E. Owens
Pennsylvania	C. R. Orton
	H. W. Thurston
	L. O. Overholtz
Rhode Island	H. W. Browning
	W. A. Snell
South Carolina ..	C. A. Ludwig
South Dakota	E. J. Petry
	A. T. Evans
Tennessee	L. R. Hesler
Texas	J. J. Taubenhaus
Utah	B. L. Richards
Vermont	B. F. Lutman
Virginia	F. D. Fromme
Washington	F. D. Heald
	B. F. Dana
	Arthur Frank
West Virginia ...	N. J. Giddings
	E. C. Sherwood
	Anthony Berg
Wisconsin	R. E. Vaughan
Wyoming	Aven Nelson

DISEASES OF FOREST AND SHADE TREES, ORNAMENTAL AND MISCELLANEOUS PLANTS IN THE UNITED STATES IN 1922

Prepared by
G. Hamilton Martin, Jr.

CONTENTS

Diseases of forest, shade and ornamental trees 394
Conifers 394
Hardwoods 409
Diseases of ornamental shrubs and plants 432
Diseases of miscellaneous plants 451

Foreword

This summary on the diseases of forest and shade trees, ornamental and miscellaneous plants in the United States in 1922 follows the same general plan as those of the preceding years. The sources upon which the information is based were as follows: (1) collaborators, (2) specialists in the Office of Forest Pathology, (3) articles in botanical journals, and (4) special reporters.

Owing to the lack of more available data it has been found necessary to present the information in list form, as usually only scattered notes on the distribution and extent of the disease have been furnished.

References have been given and in some instances brief abstracts made of recent articles which might be of service to those who do not have access to all the botanical journals. A list of collaborators is given on the opposite page. The names of the special reporters are as follows:

Bonar, Lee
Boyce, J. S.
Collins, J. Franklin
Detwiler, S. B.
Dunegan, J. C.
Fields, A. O.
Gravatt, Arthur H.
Hedgcock, G. G. & N. Rex Hunt
Henn, Adam G.
Howard, N. O.
Hubert, Ernest E.
Martin, G. H., Jr.
Metcalf, W.
PHN5 = Pathological Herbarium (Notes Number 5)
Scherer, C. M.
Sheldon, John L.
Young, V. H.
Young, Y. H.

DISEASES ON CONIFERS

ARBORVITAE (Thuja occidentalis)

Phomopsis juniperivora Hahn
Pennsylvania - State College, June 2. Coll. L. O. Overholts. (PHN 5)

Wood rot caused by Poria vaporaria (Fr.) Cke.
Minnesota - (Sect. Pl. Path.)

ARBORVITAE, GIANT (Thuja plicata)

Cedar leaf blight caused by Keithia thujina Durand
Idaho - this disease tends toward becoming very serious; found in stands of young western red cedar in northern Idaho (Schmitz)

Washington - northeastern part of state, this disease causes the trees to appear often as if swept by fire. (Schmitz)

The parasite is widespread, common and principally attacks small trees. (Boyce)

Reference
Miles, A. C. Keithia on Thuja plicata Gard. Chron. III, 72: 353. Dec. 16, 1922.

Red brown heartwood butt rot caused by Polyporus schweinitzii Fr.
Idaho - not common. (Schmitz)

Coryneum juniperinum Ell.
Oregon - occasional; apparently parasitic but not certain. (Boyce)

CEDAR, YELLOW (Chamaecyparis nootkatensis)

Rust caused by Gymnosporangium nootkatensis (Trel.) Arth.
Washington - causes little damage to the leaves of young trees. (Boyce)

CEDAR, WHITE (Chamaecyparis thyoides)

Rust caused by Gymnosporangium ellisii (Berk.) Farl.
Connecticut - first collection in state by Connecticut Agr. Exp. Sta.; quite abundant in this swamp; aecial stage reported by Fromme in the state but not yet collected by Clinton. (Clinton)
Rhode Island - found for first time; it is disfiguring many trees by the fusiform galls; some branches are dead and some smaller trees are dead, apparently from this cause. (Snell & Howard)

Rust caused by Gymnosporangium botryapites (Schw.) Kern = (G. biseptatum Ell.
Connecticut - New Haven County; two reports. (Clinton)

FIR, SILVER (Abies amabilis)

fir-fern rust caused by Uredinopsis mirabilis (Pk.) Magn.
Washington - causes death of infected needles; normally on young trees does slight damage. (Boyce)

butt rot caused by Fomes annosus (Fr.) Cke.
Washington - found occasionally in living trees; infected trees are

susceptible to windthrow. (Boyce)

FIR, BALSAM (Abies balsamea)

Fir-fern rust caused by Uredinopsis mirabilis (Pk.) Magn.
Pennsylvania - severe; local; on Osmunda claytoniana at least 8 miles from any known possible Abies; infection abundant on one local area. August 19. (Overholts)

Douglas fir blight caused by Phomopsis pseudotsugae Wilson
See quotation Douglas fir.

FIR, LOWLAND (Abies grandis)

Needle-cast caused by Lophodermium nervisequium Hart.
Idaho - common; the resulting damage, as a rule, is slight. (Boyce)

Stringy brown rot caused by Echinodontium tinctorium Ell. & Ev.
Idaho - very common wherever this tree occurs; causes a serious heart rot. (Schmitz)

Very destructive in some localities, nearly all mature trees being more or less decayed. (Boyce)

Fir-fern rust caused by Uredinopsis mirabilis (Pk.) Magn.
Idaho, British Columbia - kills infected needles; usually on small trees; damage slight. (Boyce)

Red brown sapwood rot caused by Fomes pinicola (Fr.) Cke.
Idaho - fairly common. (Schmitz)

Matting caused by Herpotrichia nigra Hart.
Idaho - common at high altitudes. (Schmitz)

Macrophoma parca B. & Br.
Oregon -(Boyce)

FIR, ALPINE (Abies lasiocarpa)

Matting caused by Herpotrichia nigra Hart.
Idaho - common at the higher altitudes. (Schmitz)

FIR, VEITCH'S (Abies veitchii)

Fusicoccum abietinum (Hart.) Prill. & Del. = (Phoma abietina Hart.)
Ohio - local; causes death of twigs and needles. Oct. 24. (Young)

FIR, DOUGLAS (Pseudotsuga taxifolia)

Red brown heartwood butt rot caused by Polyporus schweinitzii Fr.
Idaho - common. (Schmitz)

Red rot caused by Trametes pini (Brot.) Fr.
Idaho - fairly common. (Schmitz)

Red brown sapwood rot caused by Fomes pinicola Fr.
Idaho - found in dead trees, causing a saprot. (Schmitz)

Rot caused by Polyporus volvatus Pk.
Idaho - common. (Schmitz)

Douglas fir mistletoe, Razoumofskya douglasii (Engelm.) Kuntze
Idaho, Washington, Oregon. (Boyce)

Is a very serious parasite. (Boyce)

Douglas fir blight caused by Phomopsis pseudotsugae Wilson

The following quotation concerning this serious European disease that is now threatening the United States is taken from a recent article by J. S. Boyce. (A menace to Douglas fir and hemlock. Timberman, July, 1922):

"Of late years in Scotland and England a parasitic fungus (Phomopsis pseudotsugae) has been found attacking young Douglas firs in the sapling stage. The disease is becoming increasingly severe each year and is now a source of considerable concern to foresters and pathologists in those countries. The fungus attacks the main stem, either killing the tree outright or causing the death of the top, greatly retarding growth. The disease spreads directly from infested trees to sound ones, thus making it very difficult to control.

"An idea of the damage resulting is given by Dr. Malcolm Wilson, of the University of Edinburgh, who states: 'A plantation of Douglas fir in Perthshire, about 6 to 8 years old, was examined in April of this year (1920), and it was estimated that half of the trees had been killed by the disease. The dead trees were removed and burnt and the spaces were filled up by planting fresh trees. In September about 20 per cent of the trees were showing signs of attack, and these included some of those planted in the previous April.' Again the same authority writes: 'Owing to the long period which elapses between infection and the first obvious signs of the disease, it is possible that nursery stock which is apparently healthy, although really diseased, may be planted out, and in this way the disease may be widely distributed.'

"The parasite has recently been found in Scotland attacking Japanese larch (Larix leptolepis) and hemlock (Tsuga albertiana).

"If this disease is introduced anywhere into the Douglas fir regions of North America a widespread, disastrous and probably uncontrollable epidemic may quite possibly result. It is axiomatic that parasites of little importance in their native haunts often become exceedingly destructive when introduced into other regions. This particular fungus threatens the two most important timber trees in the Pacific Northwest, together with a third so-called 'inferior' species, Western larch (Larix occidentalis), which as time goes on will become increasingly valuable. It is also quite probable that this parasite will attack balsam firs."

HEMLOCK (Tsuga canadensis)
Leaf rust caused by Pucciniastrum myrtilli (Schum.) Arth. = (Peridermium peckii Thuem.)
Pennsylvania - seems to be more abundant than last year. (Overholts)

HEMLOCK, WESTERN (Tsuga heterophylla)

Stringy brown rot caused by Echinodontium tinctorium Ell. & Ev.
Idaho, Oregon (Boyce)

The most destructive decay of hemlock; where infection is severe practically every mature tree is affected. (Boyce)

Ring scale rot caused by Trametes pini (Thore) Fr.
Washington (Boyce)

Butt rot caused by Fomes annosus (Fr.) Cke.
Washington (Boyce)

Occasionally attacks hemlock. (Boyce)

Dimerium sp.
Washington - not on needles of the season; immature on 1920 needles, mature on 1919 needles. (Boyce)

Douglas fir blight caused by Phomopsis pseudotsugae Wilson
See quotation under Douglas fir.

HEMLOCK (Tsuga albertiana)

Douglas fir blight caused by Phomopsis pseudotsugae Wilson

See quotation under Douglas fir.

HEMLOCK (Tsuga spp.)

Leaf, cone, and twig rust caused by Melampsora abietis-canadensis (Farl.) Ludwig = (Caeoma abietis-canadensis Farl.)
Connecticut - aecial stage on cones of the hemlocks was more abundant than I had ever seen it; have seen twigs with most of the cones and young twigs conspicuously infected, however, the Melampsora stage on the Populus was not as common as usual. (Clinton)

Rust, caused by Pucciniastrum myrtilli (Schum.) Arth. = (Peridermium peckii Thuem.)
Connecticut - becoming more prevalent; reported from four western counties. (Clinton)

JUNIPER, COMMON (Juniperus communis var. hemisphaerica)

Pestalozzia funerea Desm.
District of Columbia (Collins)

JUNIPER, WESTERN (Juniperus occidentalis)

Rust caused by Gymnosporangium harknessianum (E. & E.) Kern
Oregon - little injury caused by this parasite to host. (Boyce)

Rust caused by Gymnosporangium juvenescens Kern
Oregon - causes little injury to host. (Boyce)

Rust caused by Gymnosporangium kernianum Bethel
Oregon - sometimes found; causes little or no injury to host. (Boyce)

Hormodendron pinophilum (Ness) Lindau.
Oregon - common. (Boyce)

JUNIPER, ROCKY MOUNTAIN (Juniperus scopulorum)
Rust caused by Gymnosporangium nelsoni Arth.
British Columbia - Fort Steele Oct. 9. (Boyce)

JUNIPER (Juniperus virginiana)
Rust caused by Gymnosporangium juniperi-virginianae Schw.
Rhode Island - galls on red cedar were not only very abundant in the spring of 1922 but very large with unusually long horns; some of the galls with the horns were as large as, small to medium sized apples, a little smaller than a man's closed fist. (Snell)
Connecticut - general in distribution; common but not serious. (Clinton)
Delaware - generally distributed, cedar apple galls fruited very abundantly and weather conditions favorable to produce heavy infection on apple. (Adams)
Ohio - most marked in southern Ohio and extreme northern portion of state. (Thomas)
Illinois - less than usual; prevalent largely in southern part of state, reported especially in Whiteside County on Mississippi bluffs. (Tehon)

Rust caused by Gymnosporangium germinale (Schw.) Kern = (G. clavipes Cke. & Peck)
Massachusetts - (Collins)
Connecticut - local. (Clinton)
Delaware - more prevalent than in former years. (Adams)

Reference:
Dodge, B. O. Studies in the genus Gymnosporangium. IV. Distribution of the mycelium and the subcuticular origin of the telium in G. clavipes. Amer. Journ. Bot. 9: 354-365. July 1922.

Rust caused by Gymnosporangium sp.
Vermont - very prevalent. (Lutman)

JUNIPER (Juniperus sp.)
Pestalozzia funerea Desm.
South Carolina-(Collins)

LARCH, WESTERN (Larix occidentalis)
Brown trunk rot caused by Fomes officinalis Fr. (F. laricis (Jacq.) Murr.)
Idaho - quite common, causing considerable loss. (Schmitz)

Needle cast caused by Hypodermella laricis Tub.
Idaho - especially severe in northern Idaho during 1922; smaller trees were sometimes almost completely defoliated by early summer, which cannot but help to decrease the rate of growth, and, without doubt, the disease is more important than is usually considered. (Schmitz) Reported also by Boyce.

Oregon - an epidemic occurred in the Ochoco Mountains near Mitchell, Wheeler County, July 27, where, in an area of infection, the trees were almost defoliated. (Boyce)

Larch mistletoe - Razoumofskya laricis Piper
Idaho - very common in certain localities throughout range of host in state. (Schmitz)
Oregon - is very destructive. (Boyce)

Ring scale rot caused by Trametes pini (Brot.) Fr.
Idaho - occasionally found. (Schmitz)
Results in heavy loss in merchantable stands. (Boyce)

Red brown heartwood butt rot caused by Polyporus schweinitzii Fr.
Idaho - fairly common. (Schmitz)

Sulphur heart rot caused by Polyporus sulphureus (Bull.) Fr.
Idaho - has been collected on larch in northern Idaho several times during past seasons. (Schmitz)

Douglas fir blight caused by Phomopsis pseudotsugae Wilson.

See quotation under Douglas fir.

LARCH, JAPANESE (Larix leptolepsis)
Douglas fir blight caused by Phomopsis pseudotsugae Wilson

See quotation under Douglas fir.

PINE, SLASH OR SWAMP (pinus caribaea)
Rust caused by Coleosporium delicatulum (Arth. & Kern.) Hedgc. & Long.
Florida and Louisiana (Hedgc. & Hunt)

PINE, LODGEPOLE (Pinus contorta)
Needle cast caused by Lophodermium pinastri (Schrad.) Chev.
British Columbia - usually attacks the older needles; quite common but of little economic importance except when epidemic. (Boyce)

Rust caused by Cronartium comptoniae Arth. = (Peridermium comptoniae (Arth.) Orton and Adams)
Connecticut - new host for the state; Coscob, Fairfax County, June 13; partly responsible for killing out a young plantation. (Clinton)

Western fusiform rust caused by Cronartium filamentosum (Pk.) Hedgc. & Long.
Oregon - common locally; sometimes kills small trees. (Boyce)

Western pine gall rust caused by Cronartium harknessii. (Moore) Meinecke
Idaho - very common in many localities; often galls will be found occurring in great numbers on individual trees. (Schmitz)
Oregon, British Columbia - quite common; infection of galls and witches brooms. (Boyce)

Lodgepole pine mistletoe - Razoumofskya americana (Nutt.) Kuntz
Idaho - (Boyce and Schmitz), Oregon (Boyce)
Reduces the growth of all infected trees and causes huge witches brooms. (Boyce)

Red brown heartwood butt rot caused by Polyporus schweinitzii Fr.
Idaho - common on older trees. (Schmitz)

Needle blight caused by Hypoderma deformans Weir
Oregon - occasionally parasitic. (Boyce)

Lophodermella montivaga Petrak
Oregon - parasitic, almost defoliating the trees; abundant locally. (Boyce)

Stillospora pinicola B. & C.
Oregon - abundant; parasitic on the older needles. (Boyce)

PINE, JACK (Pinus divaricata) . = (P. banksiana)
Rust caused by Coleosporium helianthi (Schw.) Arth.
Michigan - (Hedgc. & Hunt)
Rust caused by Cronartium cerebrum (Pk.) Hedgc. & Long
Minnesota - (Sect. Pl. Path.)

PINE, SHORT LEAF (Pinus echinata)
Rusts caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long = (Peridermium delicatulum (Arth. & Kern) Hedgc. & Long)
Pennsylvania, Maryland and South Carolina. (Hedgc. & Hunt)

Coleosporium helianthi (Schw.) Arth. = (Peridermium helianthi (Schw.) Hedgc. & Hunt)
Georgia - (Hedgc. & Hunt)

Coleosporium inconspicuum (Long) Hedgc. & Long
Georgia and North Carolina (Hedgc. & Hunt)

Coleosporium terebinthinaceae (Schw.) = (Peridermium terebinthinaceae (Schw.) Hedgc. & Hunt)
North Carolina, South Carolina, Georgia, and Alabama. (Hedgc. & Hunt)

Coleosporium vernoniae B. & C. = (Peridermium carneum (Basc.) Seym. & Earle)
Delaware - more prevalent than in the average year; very prevalent on young seedlings. (Adams)

PINE, SUGAR (Pinus lambertiana)
Needle cast caused by Lophodermium pinastri (Schrad.) Chev.
Oregon - frequent. (Boyce)

PINE, ARIZONA LONG-LEAF (Pinus mayriana)
Rust caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long
District of Columbia (Hedgc. & Hunt)

PINE, WESTERN WHITE (Pinus monticola)

White pine blister rust caused by Cronartium ribicola Fisch

Idaho - not found in the state, after a quite extensive scouting season. (Schmitz)

Washington - during the summer of 1922 white pine blister rust was found on Ribes in the following counties of western Washington: San Juan, Island, Whatcom, Skagit, King, Pierce, Clallam, Jefferson, Kitsap, Mason, Grays Harbor and Pacific; the disease up to the fall of 1922 had not been found on pines except a single canker of 1917 origin at Blaine, near the international line in Whatcom County, and two small pines in a nursery at Mt. Vernon in Skagit County. (Detwiler)

Needle cast caused by Lophodermium pinastri (Schrad.) Chev.

Washington - is usually saprophytic on this host but sometimes becomes parasitic; little damage resulting. (Boyce)

Ring scale rot caused by Trametes pini (Thore) Fr.

Idaho - very common. (Schmitz)

Very destructive in over-mature stands. (Boyce)

Yellow root rot caused by Sparassis radicata Weir

Idaho - (Schmitz)

PINE, AUSTRIAN (Pinus nigra var. austriaca)

Sphaeropsis sp.

New York - (Collins)

PINE, CORSICAN (Pinus nigra poiretiana)

Rust caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long

Pennsylvania - (Hedgc. & Hunt)

PINE, LONG LEAF (Pinus palustris)

Rusts caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long.

South Carolina, Georgia, Florida, and Mississippi. (Hedgc. & Hunt)

Coleosporium inconspicuum (Long) Hedgc. & Long

South Carolina (Hedgc. & Hunt)

Coleosporium terebinthinaceae (Schw.) Arth.

South Carolina (Hedgc. & Hunt)

PINE, WESTERN YELLOW (Pinus ponderosa)

Needle cast and witches broom caused by Hypodorma deformans Weir

Washington, British Columbia - trees of all ages are attacked; the increment of infected trees is lessened. (Boyce)

Pine commandra rust caused by Cronartium pyriforme (Pk.) H. & L.
Washington, Or egon - This rust is locally destructive but the total damage is limited due to the fact that the alternate host commandra is not widespread; kills young trees. (Boyce)

Western pine gall rust caused by Cronartium harknessii (Moore) Meinecke
Idaho - fairly common but does not seem to do a great amount of damage to western yellow pine. (Schmitz)
British Columbia - causes galls and small witches brooms on infected trees. (Boyce)

Heart rot caused by Fomes laricis (Jacq.) Murr.
Washington - may extend throughout the heartwood of over mature trees. (Bovce)

Needle cast caused by Lophodermium pinastri (Schrad.) Chev.
Idaho - common but does not seem to do as much damage as Hypoderma deformans. (Schmitz)
Oregon - epidemic at times causing a considerable number of small trees to lose a large percentage of their needles. (Boyce)

Pacific slope yellow pine mistletoe - Razoumofskya campylopoda (Engelm.) Piper = (R. robusta)
Idaho - common; often causes enormous brooms. (Schmitz)
Very widespread; abundant on trees of all ages. (Boyce)

PINE, YELLOW (Pinus ponderosa)
Mistletoe - Razoumofskya campylopoda (Engelm.) Piper
An article by W. J. Perry, (Can Mistletoe be eradicated by pruning? Journal of Forestry 20: 627-628. Oct. 1922). The author states that mistletoe can be eradicated from individual young trees by pruning them. The operation, though, must be repeated after two years. This is to eradicate the young mistletoe plants which were not noticeable at the first pruning and before they can bear seed, as it has been observed that some plants bear seed in the third year. In order actually to rid an area of mistletoe it is necessary to fell all infected trees which have no commercial value, as well as to prune those selected for use. Whether it is practical to practice such intensive forestry when the stumpage is only worth about a dollar or two is a question to be thoughtfully considered.

White pouch fungus caused by Polyporus volvatus Pk.
Idaho - quite common, especially after trees have been injured by fire. (Schmitz)
Reference:
Schmitz, Henry. Note concerning decay of western yellow pine slash caused by Polyporus volvatus Pk. Phytopath. 12: 494-496. Oct. 1922.

Rot caused by Polyporus eurbescens Fr.
Idaho - a rare species, collected near Sandpoint. (Schmitz)

PINE, PARRY PINION (Pinus quadrifolia)

Needle blight caused by Hypoderma sp.
Oregon (Boyce)

PINE, RED (Pinus resinosa)

Wood rot caused by Flammula alnicola Fr.
Minnesota - saprophytic (Sect. Pl. Path.)

Wood rot caused by Polyporus sulphureus (Bull.) Fr.
Minnesota (Sect. Pl. Path.)

Rust caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long
Vermont - Hedgc. & Hunt)

Damping-off caused by Rhizoctonia solani Kühn
Connecticut - serious in seed beds. (Clinton)

PINE, PITCH (Pinus rigida)

Dying of needles cause undetermined.
Massachusetts - on Cape Cod, in the town of Falmouth, one stretch of pitch pines of two or three square miles was affected by some trouble which evidenced itself in the dying of about half of the distal portion of the needles, the whole woods as far as the eye could see was bronzed. The only fungus found, as identified by N. O. Howard, was Hypoderma desmazieri and this was not abundant; whether or not this was the cause of the trouble or secondary could not not be determined. (Snell)

Rust caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long
Massachusetts, Connecticut, New York, Pennsylvania, Maryland, District of Columbia, and North Carolina. (Hedgc. & Hunt)

Coleosporium terebinthinaceae (Schw.) Arth.
North Carolina (Hedgc. & Hunt)

PINE, POND (Pinus serotina)

Rusts caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long
New Jersey, South Carolina, Georgia, and Florida. (Hedgc. & Hunt)

Coleosporium terebinthinaceae (Schw.) Arth.
South Carolina (Hedgc. & Hunt)

PINE, WHITE (Pinus strobus)

Dry rot caused by Fomes pinicola Fr. & Cke.
New Hampshire - occurs abundantly on white pine in the white mountains, especially on the older stands; it is causing the decay of many of many of the trees in the famout Cathedral Woods at Intervale, where it is causing a butt rot instead of a bole rot due to the poor pruning which gives the fungus entrance near the ground line, instead of higher. (Snell)

Wood rot caused by Hydnum coralloides Scop.
Minnesota - (Sect. Pl. Path.)

Leaf cast caused by Hypoderma brachysporum (Rostr.) Tub.
Maine, New Hampshire, Massachusetts, and Rhode Island. (Collins)

Polyporus schweinitzii Fr.
New Hampshire - abundant on the ground, growing from the roots. (Snell)

Cryptosporium pini B. & C.
Maine - Kittery Point (Pierce)

Septobasidium pinicola Snell
New Hampshire - North Conway
"Found in all of the New England states but Rhode Island and in New York; no collections in Canada or in the middle western white pine states are known; according to Weir, the same species occurs on Pinus monticola in the western white pine states; collected in Idaho by Weir." Snell, W. H. A New Septobasidium on Pinus strobus. Mycologia 14: 55-60. Mar. 1922.

Fusicoccum sp.
New Hampshire, Massachusetts, and Delaware. (Collins)

Ant canker caused by Formica exsectoides.
Connecticut - causes a canker of dead bark at base of young trees; the ants build nests and then sting in formic acid in base of trees, especially in young plantations to kill them or get rid of shade; sometimes considered winter or Phoma canker. (Clinton). This trouble, though caused by ants, is included here on account of its probably helpful suggestion to those who may have noticed similar cankers and were not aware of the real cause.

Chemical injury
Snell, W. H. & Howard, N. O. Notes on chemical injuries to the eastern white pine (Pinus strobus L.) Phytopath. 12: 362-368. Aug. 1922.

Sun scald
Massachusetts - rather less than in recent years, general in range throughout state, causes a die-back of the needles; one of the most commonly reported troubles of the white pine. (Osmun)

Needle blight - cause undetermined
Massachusetts, Rhode Island, New York, and District of Columbia (Collins)

Needle drop - probable cause , late frosts.
Connecticut - more prevalent; seen only in the years 1921-1922. The needles of the present year die at their base and finally drop off; has a serious aspect. Found in Fairfield, New Haven and New London Counties; earliest report was in June. (Clinton)

Damping-off caused by Rhizoctonia solani Kuhn
Connecticut - one report of serious injury to seed beds, July 11 at Cheshire, New Haven County. (Clinton)

White pine blister rust caused by Cronartium ribicola Fischer
A report of the white pine blister rust control work in the United States in 1921 and 1922 has already been given (Pl. Dis. Bul. Suppl. 23:439-441 and it is not thought necessary to repeat the summary of the 1922 results here.

STATUS OF WHITE PINE BLISTER RUST CONTROL IN PENNSYLVANIA IN 1922
(Prepared by J. F. Martin, Office of Blister Rust Control)

The first report of the white pine blister rust on Ribes in Pennsylvania was made in the fall of 1921, by S. B. Detwiler of the U. S. Bureau of Plant Industry, who found infection on cultivated black currants in Wayne County. Subsequently, additional infections were found on pine and Ribes in Wayne County by representatives of the Pennsylvania Bureau of Plant Industry and of the Pennsylvania Department of Forestry. Also, one infection was reported from Montrose, Susquehanna County, by Prof. Overholts of the Pennsylvania State College. Prior to 1921, the blister rust had been found on planted white pine in Berks, Montgomery, Monroe and Cambria counties, but the diseased trees were destroyed before the rust had a chance to spread to the leaves of Ribes. No infection was found during 1919 and 1920.

The discovery of the rust in northeastern Pennsylvania led to a more thorough survey in 1922. The Pennsylvania Department of Forestry undertook a survey of Wayne and Susquehanna counties to determine the amount and distribution of white pine as a basis for the intelligent application of control measures. It is stated that Wayne County, with a total area of 472,960 acres, had 283,707 acres or 59.9 per cent forest land. Of this area 116,398 acres are in farm woodlots. Hardwoods predominate and white pine is not abundant in any part of the county. Stands of merchantable white pine, covering 475.8 acres, were estimated to contain 1,977,575 board feet. Immature white pine occurs in commercial quantities on 773.6 acres, and is found in small amounts on 4725.6 acres.

Susquehanna County has a total land area of 527,360 acres, with 180,000 acres, or 34 per cent, in forests. A large, additional acreage of unimproved farm land will ultimately revert to forest. The composition of the forests is chiefly hardwoods, with white pine occurring in limited quantities. Only 92.1 acres of merchantable white pine totaling 780,500 board feet were located in the county, while immature white pine in commercial quantities occurs on 51.3 acres. White pine is slowly invading abandoned pastures to some extent but is losing ground when in mixture with hardwoods and hemlocks.

During the past season, the Pennsylvania Bureau of Plant Industry in cooperation with the Federal Department of Agriculture, conducted a survey to determine the distribution of the rust and secure data on the habitat and abundance of its alternate host, currants and gooseberries. Inspections were made in 118 localities in 10 counties, in two of which the disease was found. One infection on Ribes nigrum was located near Carbondale, Lackawanna County, while in Wayne County three infections were discovered on R. nigrum and one on R. cynosbati, the wild prickly gooseberry, in an abandoned orchard pasture. The only wild Ribes found diseased in 1921 were growing in this same pasture.

A survey to determine the distribution of wild Ribes was conducted in connection with the scouting for the disease. An examination was made of the wild bushes growing on 69 areas selected in Northampton, Monroe, Pike, Wayne, Luzerne, Sullivan, Bradford, Wyoming and Susquehanna counties. The sample plots totaled 99.25 acres and averaged 5.8 bushes per acre. The principal species was R. cynosbati, which is plentiful on rocky hillsides and stony pastures. A few plants of R. rotundifolium were observed but this species is not very common.

In making the survey 4 types of habitat were selected, viz., woodland, pasture, swamp and fence rows. The pasture type had an average of 12 bushes per acre on 23 areas covering 38.5 acres. On 42 areas in the woodland type, totaling 56.25 acres, the Ribes averaged 2 per acre. Along 13 fence rows, covering 3485 yards, the Ribes were found to average 1.8 bushes per hundred yards. Only 4 swamps were examined as they are comparatively scarce in the region scouted. Ribes were absent in 3 of the swamps and only a few bushes were found in the fourth.

Control of the blister rust in the region examined should not be difficult owing to the comparatively small number of wild Ribes and the scattered occurrence of white pine. However, since the rust is present in northeastern Pennsylvania, owners of good stands of young pine should take immediate steps to protect them by destroying all currants and gooseberries in the vicinity of the trees.

Recent literature

Boyce, J. S. White pine blister rust in the Pacific Northwest. (Abstract) Phytopath. 12: 448. Sept. 1922.

Colley, Reginald H. and Minnie W. Taylor. Studies in the aecial stages of Cronartium ribicola and Cronartium occidentale. (Abstract) Phytopath. 13: 46-47. Jan. 1923.

Cooper, Wm. S. The ecological life history of certain species of Ribes and its application to the control of the white pine blister rust. Ecology 3: 7-16. 1922.

Detwiler, S. B. Blister rust appears in the Puget Sound region. Amer. Forestry 28: 97-98. 1922.

_____ Cooperative white pine blister rust control. Month. Bul. Dept. Agr. Calif. 11: 636-638. Aug. & Sept. 1922.

Dufroney, Jean. The occurrence of Cronartium ribicola in Europe. Phytopath. 12: 302-304. June 1922.

Eriksson, Jakob. The connection between Peridermium strobi Kleb. and Cronartium ribicola Dietr. is it obligate or not? A critical review. Ark. f. Bot. 18: 1-40. (Bibliography: p. 37-39. 1922)

Filley, W. O. and H. W. Hicock. Control of white pine blister rust in Connecticut. Conn. Agr. Exp. Sta. Bul. 237: 305-326. Feb. 1922.

Heald, F. D. Report on blister rust of white pine. Washington State College Sta. Bul. 167: 38-43. 1922.

Hofmann, J. V. White pine blister rust. Timberman 23: 33-35. Mar. 1922.

Metcalf, Haven. White pine blister rust in the northwest. (Abstract) Phytopath. 13: 46. Jan. 1923.

Posey, G. B. and J. S. Boyce. White pine blister rust in the western United States. U. S. Dept. Agr. Circ. 226: 1-7. 1922.

Spaulding, Perley. Investigations of the white pine blister rust. U. S. Dept. Agr. Bul. 957: 100. 1922.

_____ Foreign studies of white pine blister rust. (Abstract) Phytopath. 13: 45. Jan. 1923.

_____ Viability of telia of Cronartium ribicola in early winter. Phytopath. 12: 221-224. 1922.

Taylor, Minnie W. Potential sporidia production per unit in Cronartium ribicola. Phytopath. 12: 298-300. June 1922.

_____ White pine blister rust infection through grafted roots. (Abstract) Phytopath. 13: 46. Jan. 1923.

York, H. H. & W. H. Snell. Experiments in the infection of Pinus strobus with Cronartium ribicola. Phytopath. 12: 148-150. Mar. 1922.

PINE, SCOTCH (Pinus sylvestris)

Damping-off caused by Rhizoctonia solani Kuhn
Connecticut - locally serious in seed beds. (Clinton)

Dothiorella pinastri (Fr.) Sacc.
Oregon - apparently weakly parasitic on trees badly injured by root pruning during transplanting. (Boyce)

PINE, LOBLOLLY (Pinus taeda)

Rusts caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long
Virginia, North Carolina, South Carolina, Florida, and Texas. (Hedgc. & Hunt)

Coleosporium terebinthinaceae (Schw.) Arth.
South Carolina and Alabama. (Hedgc. & Hunt)

Septoria acicola (Thuem.) Sacc.
Florida - Florida National Forest (Western Div.) July 5. Coll. E. J. Boone. (PHN5)

PINE, SCRUB (Pinus virginiana)

Rusts caused by Coleosporium helianthi (Schw.) Arth.
Pennsylvania, Maryland, Virginia, West Virginia, Tennessee, North Carolina and Georgia. (Hedgc. & Hunt)

Cronartium cerebrum (Pk.) Hedgc. & Long = (Peridermium cerebrum Pk.)
Delaware - very prevalent, first recorded appearance in April at Houston. (Adams)

PINE (Pinus spp.)

Anthracnose caused by Colletotrichum sp.
Ohio - severe in seed beds; kills the growing points of the seedling; period of greatest injury during August and September; disease confined to nursery seed beds. (Detmers)

Daedalea berkeleyi Sacc.
Florida - Brooksville. Coll. J. A. Stevenson (PHN5)

Scaly Lentinus rot caused by Lentinus lepideus Fr.
District of Columbia - on living tree in front and west of the Old National Museum; found growing out of branch scars. (Martin)

Lophodermium blight caused by Lophodermium sp.
Kansas - (White)

Tuckahoe or Poria cocos (Schw.) Wolf. (Pachyma cocos) (Sclerotium giganteum Macbride) (Sclerotium cocos Schw.)
Summary of article by F. A. Wolf in Jour. Elisha Mitchell Soc. 38: 127-137. Sept. 1922.
"This study of the southern tuckahoe, Pachyma Cocos, includes an account of its history, structure and origin together with the development and morphology of its fruiting stage. The spore stage

is described for the first time and the name Poria cocos is attached."

Pine cone rusts caused by Cronartium strobilinum (Arth.) Hedgc. & Hunt
Hedgcock, G. G. G. G. Hahn, & N. R. Hunt. Two important pine cone rusts and their new c.onartial stages. Phytopath. 2: 109-122. Mar. 1922.

Root rot caused by various damping-off fungi.
Rathbun, A. E. Root rot of pine seedlings. Phytopath. 12: 213-220. May, 1922.

SEQUCIA (Sequoia sempervirens)
Helotium sphaerophoides Phill. & Harkn.
Oregon - very common; many needles killed. (Boyce)

Cankers
Dufrency, Jenn. Tumeurs de Sequoia sempervirens Bul. Soc. Path. Veg. France. 9: 148-150.

SPRUCE, WHITE (Picea canadensis)
Leaf cast caused by Lophodermium sp.
Minnesota - Itasca County, Aug. 7. (Sect. Pl. Path.)

SPRUCE, ENGELMANNI(Picea engelmann)
Needle rust caused by Chrysomyxa weirii Jackson
Idaho - occasionally found, but not common. (Schmitz)
Oregon - causes premature death and dropping of infected needles. (Boyce)

Stringy brown rot caused by Echinodontium tinctorium Ell. & Ev.
Idaho - not common. (Schmitz)

Matting caused by Herpotrichia nigra Hart.
Idaho - common at high elevations on small trees. (Schmitz)

SPRUCE, BLACK (Picea mariana)
Rust caused by Melampsoropsis cassandrae (Pk. & Clinton) Arth.
Minnesota (Sect. Pl. Path.)

SPRUCE (Picea spp.)

Rust caused by Melampsoropsis ledicola (Pk.) Arth.
Wisconsin, Minnesota (Collins)

YEW, WESTERN (Taxus brevifolia)
Needle blight caused by Diplodia taxi (Dow.) De Not (?)
Oregon - of occasional occurrence; mostly on needles of the season, rarely on needles of past season. (Boyce)

Heart rot - cause unknown
Idaho - common. (Schmitz)

DISEASES OF HARDWOODS

ACACIA (Acacia farnesiana)
Ravenelia australis Diet. & Neg.
Texas - (PHN5)

ALDER, RED (Alnus oregona)
Canker attributed to a Cytospora sp.
Washington - a severe attack of what appears to be a species of Cytospora has been reported on this host; every tree up to ten feet high killed outright over a quarter of an acre and the parasite is spreading rapidly. Found on Lummi Island, Whatcom County, August 9. (Boyce)

White heart rot caused by Fomes igniarius (L.) Fr.
British Columbia - of little economic importance. (Boyce)

Leaf spot - caused by Gloeosporium cylindrospermum (Bon.) Sacc.
Oregon - common; elevation 900 feet. (Boyce)

ALDER, MOUNTAIN (Alnus tenuifolia)
Powdery mildew caused by Phyllactinia corylea (Pers.) Karst.
British Columbia - little injury results. (Boyce)

Catkin deformation caused by Exoascus tosquinetii Sacc. (Exoascus amentorum Sade.) (Taphrina amentorum Sade.)
Idaho - very severe in some localities; fruits on practically all trees being deformed, of little real economic importance due to host's economic position. (Boyce)

Leaf spot caused by Gloeosporium cylindrospermum (Bon.) Sacc.
Oregon - found at elevation of 3800 feet. (Boyce)

ASH, WHITE (Fraxinus americana)
Rust caused by Puccinia peridermiospora (Ell. & Tracey) Arth = (P. fraxinata (Lk.) Arth) (Aecidium fraxini Schw.)
Massachusetts - (Collins)
Delaware - much more than in previous years; very serious in 1922; maximum found in any one planting, about 40%; general throughout state; varietal forms were particularly susceptible; the young twig growth as well as the fruit was very seriously infected. (Adams)
Minnesota - very heavy infection along the river banks; earliest date reported May 27. (Sect. Pl. Path.)

Wood rot caused by Polyporus picipes Fr.
Minnesota - (Sect. Pl. Path.)

ASH, GREEN - (Fraxinus lanceolata)
Rust caused by Puccinia peridermiospora (Ell. & Tracy) Arth.
Minnesota - (Sect. Pl. Path.)
North Dakota - common but not important. (Weniger)

ASH, OREGON (Fraxinus oregona)
Leaf blight caused by Cylindrosporium californicum Earle
Oregon - produces a premature browning of the leaves. (Boyce)

ASH, RED (Fraxinus pennsylvanica)
Leaf spot caused by Ramularia fracinea Davis
Wisconsin - (PHN5)

ASH (Fraxinus spp.)
Rust caused by Puccinia peridermiospora (Ell. & Tracey) Arth.
New Hampshire - (Butler)
Massachusetts - more than in 1921; unusually severe; confined largely to the eastern part of the state along the coast; earliest date reported June 15; there seemed to be an epiphytotic during the year. (Osmun)
Rhode Island - the rust on ash was very abundant in the state; have not noted such abundance since the wet summer of 1916. (Snell)
Kansas - (White)

Leaf spots, cause undetermined.
Texas and Kansas

Heart rot caused by Fomes fraxinophilus Pk.
Ohio - general in distribution and severity. (Scherer)

ASH, MOUNTAIN (Sorbus americana)
Rust caused by Gymnosporangium cornutum (Pers.) Arth.
Maine - (Collins)

ASH, MOUNTAIN (Pyrus sitchensis)
Frost injury
New York - injury of foliage in early spring. (Chupp)

ASH, MOUNTAIN (Sorbus scopulina (Pers.) Fr.)
Canker caused by Cytospora chrysosperma (Pers.) Fr.
Montana - Hubert, Phytopath. 10: 443. Oct. 1920.

BASSWOOD - (Tilia americana)
Phyllosticta tiliae Sacc. & Speg.
New York - (Collins)

BASSWOOD (Tilia sp.)
Anthracnose caused by Gloeosporium tiliae Oudem.
New York - found on Long Island. (Clinton)

BIRCH, WESTERN RED (Betula fontinalis)
Leaf spot caused by Septoria betulicola Pk.
Oregon - causes little injury; of no economic importance; only found once in a while. (Boyce)

Powdery mildew caused by Phyllactinia corylea (Pers.) Karst.
British Columbia - occqsionally occurs; causes little damage. (Boyce)

BIRCH, SWEET (Betula lenta)
Canker caused by Creonectria coccinea (Pers.) Seaver (Nectria coccinea Fr.)
New York - very prevalent on sweet birch in Prospect Park, Brooklyn. (Graves)

BIRCH, PAPER (Betula papyrifera)
White wood caused by Fomes everhartii (Ell. & Gall.) Schrenk
Minnesota - both parasitic and saprophytic (Sect. Pl. Path.)

Wood rot caused by Lenzites betulina (L.) Fr.
Minnesota (Sect. Pl. Path.)

Powdery sapwood rot caused by Polyporus betulinus (Ball.) Fr.

Wood rot caused by Polyporus fuscus Pers. (P. resinosus (Schrad.) Fr.)
Minnesota (Sect. Pl. Path.)

BIRCH, WHITE (Betula populifolia)
Melanconium betulinum Schm. & Kze.
Pennsylvania - (Collins)

Septoria betulina Sacc.
Wisconsin - (Collins)

BIRCH (Betula spp.)
Leaf spot caused by Septoria betulae (Lib.) Westd.)
Pennsylvania - local; very severe; on small seedlings at Seven Mountains; every leaf of seedlings badly spotted. (Overholts)

BUCKEYE, CALIFORNIA (Aesculus californica)
Leaf spot caused by Septoria aesculi (Lib.) Westd.)
California - locally very common, killing many leaves. (Boyce)

BUCKEYE (Aesculus glabra)
Leaf blotch caused by Guignardia aesculi (Pk.) Stewart.
Rhode Island - (Collins)
Ohio - less prevalent than in former years; of general occurrence throughout state. (Detmers)

BUCKTHORN (Rhamnus sp.)
Crown rust caused by Puccinia coronata Cda. (See crown rust of oats. Plant Disease Bulletin Supplement 27: 227-229. July 1, 1923)

BUTTERNUT (Juglans cinerea)

Melanconis caused by Melanconis juglandis (E. & E.) Graves = (Melanconium oblongum Berk.) (Diaporthae juglandis E. & E.)

Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Maryland, West Virginia, Wisconsin, Iowa, Canada. (Graves)

This disease probably extends over entire natural range of the butternut. (Graves)

Recent literature

Graves, Arthur H. The Melanconis disease of the butternut. (Abstract) Phytopath. 13: 47. Jan. 1923.

Anon. Why butternut trees are dying out. Amer. Nut. Jour. 18:14. Jan. 1923.

CAMPHOR (Cinnamomum camphora)

Anthracnose caused by Gloeosporium camphorae Sacc.

Texas - trace. (Taubenhaus)

Canker caused by Diplodia sp.

Texas - trace. (Taubenhaus)

Leaf spot caused by Cephaleuros virescens Kunze

Louisiana - occasionally present; causes small per cent of injury; loss very slight; earliest report of occurrence for year, April 17. (Edgerton)

Pestalozzia sp.

Howard, N. O. The relation of an undescribed species of Pestalozzia to a disease of Cinnamomum camphora. Nees & Eberm. (Abstract) Phytopath. 13: 47-48. Jan. 1923.

CASCARA (Rhamnus purshiana)

Leaf rust caused by Puccinia coronata Cda. = (Puccinia rahmni (Pers.) Wettst

British Columbia - is occasionally found; does little injury to host. (Boyce)

Leaf spot caused by Septoria blasdalei Sacc. & Syd. = (Septoria variegata Ell. & Ev.)

California - found at an elevation of 3500 feet. (Boyce)

CATALPA (Catalpa catalpa) = (C. bignonioides)

Leaf spot caused by Macrosporium catalpae Ell. & Mart.

West Virginia, Kentucky and Illinois. (Collins)

Phyllosticta catalpae Ell. & Mart.

New Jersey, Illinois - (Collins)

CATALPA (Catalpa sp.)

Leaf spot caused by Macrosporium catalpae Ell. & Mart. = (Alternaria

Connecticut - Hartford County, July 11. (Clinton)

New York - reported once during year; very severe on one tree. (Chupp)

Ohio - more than in 1921; range in state throughout northwest portion. (Detmers)

Leaf spot caused by Phyllosticta catalpae Ell. & Mart.
Louisiana - common; a considerable injury but produces little loss. (Edgerton)

Powdery mildew caused by Oidium sp.
West Virginia - practically every tree examined was mildewed. (Sheldon)

CHERRY, WESTERN CHOKE (Prunus demissa)
Canker caused by Cytospora chrysosperma (P.) Fr.
Montana - (Bubert, Phytopath. 10: 443. O. 1920)

Sclerotiniose caused by Sclerotinia demissa Dana
Washington - (Dana)

Black knot caused by Plowrightia morbosa (Schw.) Sacc.
Washington - caused considerable damage in one locality, however the host is of no economic importance. (Boyce)

Leaf blisters caused by Taphrina cerasi (Fckl.) Sade. = (Exoascus cerasi Fckl.) Sade.
Idaho - results in little injury to the host as a rule. (Boyce)

Leaf injury - non parasitic
Washington - (Dana)

CHERRY, CHOKE (Prunus melancarpa)
Volutella nectrioides Sacc.
North Dakota - (PHN5)

CHERRY, BLACK (Prunus serotina)
Polyporus sulphureus (Bull.) Fr.
New Hampshire and Rhode Island (Snell)

Leaf spot caused by Coccomyces lutescens Higgins
Illinois - very common in counties in southern part of state; one central section county reported. (Anderson & Tehon)

Powdery mildew caused by Podosphaera oxyacanthae (DC.) DeBy.
Illinois - importance slight; July 1. (Tehon)

Black knot caused by Plowrightia morbosa (Schw.) Sacc.
Massachusetts, Pennsylvania - (Collins)

CHERRY, CHOKE (Prunus virginiana)
Anthracnose caused by Coccomyces prunophorae Higgins = (Cylindrosporium padi Karst)
Connecticut - on roadside trees; July 28. (Clinton)

Brown rot caused by Sclerotinia cinerea (Bon.) Wor.
Connecticut - occasional. (Clinton)

Powdery mildew caused by Podosphaera oxyacanthae (DC.) DeBy
Connecticut - local. (Clinton)
New York - especially prevalent; over entire state. (Chupp)

Rust caused by Puccinia pruni spinosae Pers.
South Carolina - unimportant. (Ludwig)

CHESTNUT (Castanea dentata)
Blight caused by Endothia parasitica (Murr.) And.

RECENT SPREAD OF CHESTNUT BLIGHT

Prepared by G. F. Gravatt, Office of Forest Pathology

"The chestnut blight continued its steady spread southward and westward during 1922. This disease spreads faster in a region where the chestnut trees are in unthrifty condition than where the trees are vigorous. It has made fast progress down the eastern slopes of the Blue Ridge Mountains and the zone within which 80% of the trees are infected has now nearly reached North Carolina. The blight is now becoming prominent in the northwestern part of Pennsylvania, in the National Forest of that region nearly 10% of the trees being infected. In the New England states it has practically reached the northern boundary of chestnut growth.

"There are still a few native chestnut trees left around New York City, where the disease started in this country. These trees are gradually being killed but they display considerable resistance to the blight. Quite a number of oriental planted chestnuts have escaped or thrown off the blight and are now free of the disease."

New Hampshire - (Butler)

Massachusetts - general throughout the state; practically no stand of canker-free chestnut now left in state; chestnut trees rapidly becoming extinct. (Osmun)

New York - throughout state wherever chestnuts are grown; only a question of time until not a native chestnut tree will be left in the state. (Chupp)

Maryland - serious and general. (Martin)

Ohio - on varieties of cultivated American and cultural varieties of European chestnut; found in 1922 at the station plantation on thirteen-year-old cultivated American chestnuts; a small planting of grafted stock of European varieties southwest of Wooster and at Solon, Cuyahoga County; serious in nurseries. (Detmers)

Indiana - found in a nursery; one tree killed. (Gardner)

Recent Literature

Collins, J. Franklin. A noteworthy case of resistance to the chestnut bark disease. (Abstract) Phytopath. 13: 47. Jan. 1923. no. 1.

Canker caused by Fusicoccum sp,, according to C. Emlen Scott in the Monthly Bulletin of Dept. of Agr. of Calif. 11: 740-741. Oct. 1922, this disease is caused by a species of Fusicoccum which is rather closely related to Endothia parasitica. Although it has not yet appeared as virulent as the blight, it has shown itself to be capable of causing severe injury to the host under conditions that prevailed at Grass Valley, Nevada County, California. Specimens were sent to J. Franklin Collins, Office of Forest Pathology, Washington, D. C. All diseased stock was removed from the orchard which was thoroughly inspected by the State Department. The trees are being carefully watched to prevent development and spread of any infections which might appear. The first signs of the disease

are wilting and drooping of foliage, caused by girdling branches. The growing of chestnuts is still in an experimental state in California but the Sierre foothill district appears to be well adapted to the growing of chestnut trees.

Leaf spot caused by Marssonia ochroleuca B. & C.
Ohio - abundant locally; period of greatest injury July and August when host is in full leaf; favorable weather conditions. (Detmers)

Powdery mildew caused by Microsphaera alni (Wallr.) Salm.
Connecticut - reported from three counties; found chiefly on young sprouts. (Clinton)

Pennsylvania - general and severe; quite abundant during 1922 on chestnut sprouts; was fruiting by the middle of August. (Overholts)

Numularia sp.
Rhode Island (Collins)

COFFEE-TREE, KENTUCKY (Gymnocladus dioica)
Coniothyrium olivaceum Bon. var. Gymnocladi Hollos.
District of Columbia - collected by A. E. Jenkins. (PHN5)

DOGWOOD (Cornus nuttallii)
Powdery mildew caused by Phyllactinia corylea (Pers.) Karst
British Columbia - common but causes little injury to the host. (Boyce)

European canker caused by Nectria galligena Bres.
Oregon - (Phytopath. 12: 105. Feb. 1922)

ELDER (Sambucus glauca)
Canker caused by Cytospora chrysosperma (P.) Fr.
Washington - (Phytopath. 10: 443. Oct. 1920)

ELAEAGNUS ANGUSTIFOLIA
Camarosporium elaeagnellum Fairman

ELDER, MARSH (Iva oraria)
Aecidium ivae Jackson
Maryland - North Beach, Aug. 19. Coll. Stevenson, J. A. & W. N. Diehl, (PHN5)

ELM, WING (Ulmus alata)
Anthracnose caused by Gnomonia ulmea (Schw.) Thuem. = Dothidella ulmea (Schw.) E. & E. (Gloeosporium ulmeum Miller) (Phyllachora ulmi Fckl.)
Illinois - (Tehon)

ELM, WHITE (Ulmus americana)

Anthracnose caused by Gnomonia ulmea (Schw.) Thuem.
Rhode Island - (Collins)
Virginia - (Collins)
Illinois - of considerable importance in 1922; about 100% affected plants in state; caused serious defoliation; throughout state, first reported occurrence, June 17. (Tehon)

Butt rot caused by Ganoderma curtisii (Burk.) Murr.
Ohio - very severe local infection. (Scherer)

Powdery mildew caused by Phyllactina corylea (Pers.) Karst.
New York - earliest recorded appearance in 1922, July 1. (Kirby)

Red heart rot caused by Polyporus sulphureus (Bull.) Fr.
New Hampshire - has fruited abundantly during season. (Snell)
Rhode Island - abundant fruiting; found growing on telephone poles on streets of Providence. (Snell)

Twig blight caused by Poronidulus conchifer (Schw.) Murr.
Ohio - white elm shade trees are more frequently attacked than those in the open country. (Detmers)

Canker caused by Sphaeropsis sp.
Massachusetts - cankers on twigs and branches in the upper part of the Washington elm at Cambridge, April 19. (Collins)

Aborted nuts - cause uncertain.
Washington - (Dana)

Wood rot caused by Elfvingia megaloma (Lev.) Murr.
Ohio - tree was about three fourths dead; beyond saving. (Scherer)
Michigan - some trees just ready to die; others not so bad; trees in all stages of decay. (Scherer)

Macrophoma sp.
D.C. - (Collins)

ELM, SLIPPERY (Ulmus pubescens)

Anthracnose caused by Gnomonia ulmea (Schw.) Thuem.
Illinois - (Tehon)

ELM (Ulmus spp.)

Anthracnose caused by Gnomonia ulmea (Schw.) Thuem.
Vermont - more than in the past two years; 5% crop injury; loss negligible. (Lutman)
Massachusetts - rather more than usual; general over state. (Osmun)
Connecticut - more than the average amount. (Clinton)
New York - very prevalent but not of much importance; individual elm trees seem to be affected badly and almost defoliated while others of the same species and with intermingling branches are hadrly affected. (Chupp)
Oklahoma - rather prevalent. (Stratton)

Ohio - less prevalent than in average year; of slight importance in 1922; general throughout state. (Detmers)
Illinois - very severe locally; caused a 75-85% defoliation. (Scherer)

Twig blight caused by Poronidulus conchifer (Schw.) Murr.
Ohio - more than the average amount. (Detmers)

Anthracnose caused by Gloeosporium inconspicuum Cav.
Ohio - found throughout northern part of state; earliest reported appearance June 1; period of greatest injury when host is in full leaf during June and July. (Detmers)

Canker caused by Sphaeropsis ulmicola Ell. & Ev.
Wisconsin - increasing in prevalence; nursery inspectors condemned 954 trees in 20 nurseries during 1922. (Vaughan)

Texas root rot caused by Ozonium omnivorum Shear
Texas - prevalent. (Taubenhaus)

Slime flux caused by bacteria, yeast, etc.
New York - reported August 1 from Monroe County. (Chupp)

Other diseases

Hubert, E. E. "Interior dote" in elm. Hardwood Rec. V.54. No. 6. p. 18-20. illus. Ja. 10. 1923.
Föex, Etienne. La maladie des ormes. Journ. Soc. Nat. Hort. France IV, 23: 409-411. Oct. 1922.
Guyot. Notes de pathologie végétale. Bul. Soc. Path. Veg. France 8: 132-138. Feb. 1922.
Spierenburg, Dina. Een onbekende ziejte in de eepen. (Unknown disease of the elm). Verslag. en Mededeel. Plantenziektenk Dienst Wageningen 24: 131 p., pl. 1-4. 1922. Abstract in Bot. Abstr. Vol. 113, 1922.

GINGKO (Gingko biloba).
Irpex tulipiferae S.
District of Columbia - Sept. 26. Colls. A. E. Jenkins & W. W. Diehl.

GUM, BLACK (Nyssa sylvatica)
Botryosphaeria sp.
Pennsylvania - (Collins)

HACKBERRY (Celtis occidentalis)
Root rot caused by Xylaria sp.
Ohio - a large tree at Marietta just about dead. (Scherer)

Smothering disease caused by Septobasidium retiforma (B. & C.) Pat. (Telephora retiformis B. & C.)
Texas - (Taubenhaus)

Witches brooms caused by Phytophthora sp.
West Virginia - abundant in the vicinity of Morgantown. (Sheldon)

Septobasidium sp.
Texas - (Taubenhaus)

HAWTHORNE (Crataegus chrysocarpus)

Otthia crataegi Fckl.
North Dakota - (PHW5)

HAWTHORNE (Crataegus douglasii)

Rust caused by Gymnosporangium tubulatum Kern
Oregon - results in little injury to the host. (Boyce)

Cylindrosporium sp.
California - parasitic on leaves, elevation 2600 feet. (Boyce)

HAWTHORNE (Crataegus oxyacantha)

Entomosporium thumenii (Cke.) Sacc.
Massachusetts - (Collins)

HAWTHORNE (Crataegus spp.)

Rusts caused by Gymnosporangium globosum Farl.
Ohio - severe local infection. (Scherer)
Michigan - severe local infection. (Scherer)

Gymnosporangium germinale (Schw.) Kern
Delaware - much more than in 1921 and more than the average amount; fruit infection very prevalent. (Adams)

Gymnosporangium juniperi virginianae Schw.
Ohio - (Detmers)

Gymnosporangium spp.
Illinois - average amount; of slight importance during 1922; range in southern part of state; earliest report June 15; chiefly present on leaves. (Tehon)

North Dakota - same amount as in former years; found throughout eastern half of state; June 26. (Weniger)
Colorado - just present; found about Ft. Collins. (Learn)

Fire blight caused by Bacillus amylovorus (Burr.) Trev.
New York - reported from Tompkins County, August 13. (Chupp)
Illinois - Washington County, June 17. (Tehon)
Washington - may be necessary to remove native hosts in Klickitat County for effective control. (Mills)

Leaf blotch caused by Entomosporium thumenii (Cke.) Sacc.
Massachusetts - more than ordinarily important; general throughout state. (Osmun)
Connecticut - one report. (Clinton)

HAZELNUT, CALIFORNIA (Corylus californica)

Gloeosporium coryli (Desm.) Sacc.
Oregon - elevation 150-400 feet. (Boyce)

Septoria corylina Pk.
Oregon - very common, causes leaves to shrivel; elevation 900 feet.(Boyce)

HICKORY (Hicoria spp.)
Anthracnose caused by Gnomonia leptostyla (Fr.) C. s. & de Not = (Marssonia juglandis (Lib.) Sacc.)
West Virginia - on young growths near Morgantown; not very serious. (Sheldon)

Witches-brooms caused by Microstroma juglandis (Bar.) Sacc.
West Virginia - (Sheldon)

Canker caused by Rosellinia caryae Bonar
Michigan - "I have found that this disease is very generally distributed in the hickory groves along the Huron River which runs through Ann Arbor and vicinity. The typical canker may be found on the younger twigs and more rarely on the larger limbs or trunks. I never found anything except the imperfect stage of the fungus in the field." (Bonar)

Bonar, Lee. The life history of Rosellinia caryae sp. nov. causing a hickory canker and disease. Phytopath. 12: 381-385. illus. Ag. 1922. no. 8. Literature cited, p. 385.

Nut rot caused by Penicillium sp., Fusarium sp., and a Phycomycete.
Indiana - found three types of rot, a dry yellowish skeletonization with which a Penicillium was associated; a dark brown or black greasy rot with which a Phycomycete was associated, and a rot accompanied by profuse white mycelium, a Fusarium. (Gardner)

Phyllosticta sp.
Ohio - (Collins)

HORSE CHESTNUT (Aesculus hippocastanum)
Leaf blotch caused by Guignardia aesculi (Pk.) Stewart.
Maine - (Collins)
Massachusetts - becoming more prevalent, severe and widespread; general over state; weather relations apparently favorable to the disease. (Osmun)
Rhode Island - (Collins)
Connecticut - more prevalent; very common; on the European chestnuts present each year; general over state. (Clinton)
New York - getting worse; very serious during 1922; defoliation weakens the tree allowing Nectria to kill it; all over the state; all horse chestnut trees are being killed. (Chupp)
New Jersey - more than in the average year; common all over state; greatest injury during July and August; wet in June and July with normal temperature. (Dept. of Pl. Path.)
Pennsylvania - general and very severe; severe on all trees, with all leaves half to two-thirds dead by August 1. (Overholts)
Maryland - (Collins)
Ohio - less prevalent than in 1921; serious; of general range over state; unfavorable moisture conditions latter part of season although the temperature remained favorable. Ascospores are matured on the fallen leaves at time of leaf development. (Detmers)

Glomerella cingulata (Stonem) S. & V. S.
New York -(Collins)

Collybia velutipes Curt.
Rhode Island - (Collins)

Powdery mildew caused by Uncinula flexuosa Pk.
New York - (Collins)

Leaf spot caused by Septoria sp.
Pennsylvania - on leaves that otherwise appear to be infected with the blotch but the Septoria fruiting on dark areas over the blotched surface; importance has not yet been determined. (Overholts)

Coral spot caused by Nectria cinnabarina (Tode) Fr.
New Hampshire - found doing a great deal of damage to horse chestnuts in certain places in the White Mountains; some of the trees are full of dead branches covered with the coral spot. (Snell)

Schizophyllum alneum Schr.
New Jersey - (Collins)

Tubercularia sp.
Massachusetts, Rhode Island - (Collins)

LOCUST (Robinia pseudacacia)
Heart rot caused by Fomes rimosus Berk.
Massachusetts - found for the first time in southeastern part of state where the host trees line the roads between Providence and Cape Cod; these locusts are abundant in places and there is quite a good deal of this fungus in some places; it has been fruiting for some time as indicated by some of the old conks. (Snell)
West Virginia - general about Motgantown. (Sheldon)

White heart rot caused by Trametes robiniophila Murr.
Kauffman, C. H. and Kerber, H. M. A study of the white heart rot of locust, caused by Trametes robiniophila. Amer. Jour. Bot. 9: 493-508. Nov. 1922. Literature cited p. 508.

MADRONA (Arbutus menziesii)
Leaf blight - non-parasitic
Washington - (Dana)

Sphaerella arbuticola Pk.
Oregon - common; practically all leaves of previous season killed; elevation 900 feet. (Boyce)

MAPLE, DWARF (Acer glabrum)
Leaf spot caused by Phyllosticta minima (B. & C.) Ell. & Ev. = (P. minutissima E. & E.)
Idaho, British Columbia - (Boyce)
Associated with Cylindrosporium sp.; is of little importance, although quite abundant where found. (Boyce)

MAPLE (Acer interior)

Leaf spot caused by Septoria negundinis Ell. & Ev.
Utah - apparently throughout the state defoliating the trees wherever they are attacked. (Garrett)

MAPLE, OREGON (Acer macrophyllum)

White heartwood rot caused by Fomes igniarius (L.) Gill.
British Columbia. (Boyce)

Hypoderma commune (Fr.) Duby.
Oregon - on the petioles of dead leaves on the ground. (Boyce)

BOX ELDER (Acer negundo)

Leaf spot caused by Phyllosticta minima (B. & C.) Ell. & Ev. = (P. negundinis Sacc. & Speg.)
Rhode Island - (Collins)

Septomyxa negundinis
Massachusetts - (Collins)

MAPLE, STRIPED (Acer pennsylvanica)

Leaf spot - caused by Pleospora sp.
Pennsylvania - local; very severe; Aug. 19. (Overholts)

MAPLE, NORWAY (Acer platanoides)

Wilt caused by Verticillium sp.
Wisconsin - found only two trees at Madison which were destroyed. (Vaughan)

Pleospora papillata
Virginia - (Collins)

Phyllosticta (saccharina?)
Virginia - (Collins)

Leaf scorch
New York - severe. Henn

MAPLE, RED (Acer rubrum)

Sap rot caused by Schizophyllum commune Fr.
Ohio - general; severe; a number of young trees had been transplanted and sun-scalded; fruiting bodies appearing around edge of many wounds. (Scherer)

Pholiota adiposa Fr.
New Hampshire - (Snell)
Massachusetts - (Snell)

MAPLE, SUGAR (Acer saccharum)

Leaf spot caused by Gloosporium apocrytum Ell. & Ev.

Massachusetts - not serious ; of general range in state. (Osmun)

Ohio - extremely prevalent and virulent; reported from 5 western, 2 northern, and 1 north central county. (Detmers)

Indiana - worse than in 1921 and the average year; caused much alarm to owners of shade trees throughout central part of state; May 18 first reported appearance in 1922; a heavy period of greatest injury during last of May; rainfall in April favored this disease. (Gardner)

Anthracnose caused by Gloeosporium saccharina Ell. & Mart.

Connecticut - three reports from two counties, June 19. (Clinton)

Stegamosporium piriforme (Hoffm.) Cda.

Rhode Island - (Collins)

Leaf scorch -(Collins)

New York - severe Henn)

Gloeosporium sp.

New Jersey - (Collins)

Leaf spot - probably Phyllosticta sp.

West Virginia - on the shaded side of a tree in Morgantown. (Sheldon)

Leaf spot caused by Phyllosticta minima (B. & C.) Ell. & Ev.

Tennessee - (Collins)

Phenacoccus sp.

Rhode Island - (Collins)

MAPLE, SILVER (Acer saccharium)

Pholiota adipose Fr.

New Hampshire - found in several places. (Snell)

Massachusetts - (Snell)

Delaware - apparently a wound parasite on a shade tree. Nov. (Adams)

MAPLE, MOUNTAIN (Acer spicatum)

Wood rot caused by Exidia glandulosa Fr.

Minnesota - saprophytic . Aug. 5. (Sect. Pl. Path.)

MAPLE (Acer spp.)

Leaf spot caused by Gloeosporium apocryptum Ell. & Ev.

New Hampshire

New York - (Collins)

South Carolina - unimportant; July 18. (Ludwig)

Ohio - more than in former years; serious; of general range in state. (Detmers)

Indiana - (Collins)

Leaf spot caused by Gloeosporium apocryptum Ell. & Ev.
Ohio - weather conditions evidently favorable. (Detmers)
Disease quite general throughout eastern part of state; some trees slightly infected, others almost wholly defoliated. (Scherer)

Leaf spot caused by Phyllosticta minima (B. & C.) Ell. & Ev. = (Phyllosticta acoriola).
Massachusetts - of little importance. (Osmun)
Connecticut - new to the state; seems to have been bad in certain sections. (Clinton)

Leaf spot caused by Phyllosticta spp.

Recent literature
Ciferri, R. Notae mycologicae et phytopathologicae. Ann. Mycol. 20: 34-53. illus. Pl. 1922. no. 1/2 Lavori citati: p. 51-52.

Tar leaf spot caused by Rhytisma acerinum Fr.
Massachusetts - not of much consequence; practically confined to Acer rubrum and A. saccharinum. (Osmun)
Delaware - more than in past and average year; of general range in state; leaf infection on A. rubrum and A. saccharinum prevalent. (Adams)
Indiana - (Gardner)

Black specked leaf spot caused by Rhytisma punctatum Fr.
Massachusetts - unimportant; common on young trees in shade of forest; seldom on mature trees. (Osmun)

Tar leaf spot caused by Rhytisma sp.
Arkansas - more prevalent; severe. (Elliott)

Stegnosporium piriforme (Hoffm.) Cda.
Pennsylvania - (Collins)

Wilt caused by Verticillium sp.
Virginia - at Roanoke during the past year more than 300 trees in the city parks and along the streets have died from this disease, so states an article in the Roanoke "Times" for Sept. 13.

Recent literature
Schoene, W. J. Thirteenth report of the state entomologist and plant pathologist. Quart. Bull. Virginia Crop Pest Commission. 34: 30. 1922.

White butt rot caused by Fomes applanatus (Pers.) Wallr.
Connecticut - on living trees injuring heartwood at least; Middlesex and New Haven Counties. (Clinton)

Chlorosis caused by too much lime.
Texas - prevalent; about an 8% reduction in yield for state. (Taubenhaus)

Sun scorch
Connecticut - more than usual; June 17; seven reports. (Clinton)

Leaf scorch by lightning
Connecticut - several doubtful cases where leaves suddenly were killed and turned brown that may have been so caused but exact data is wanting. (Clinton)

Leaf scorch caused by high temperatures and dry soils.
New York - less prevalent than usual, but always inportant; causes a tip burn and killing of foliage; July 28; a few days of hot, dry wind causes severe scorching of leaves on many shade trees, especially maple. (Chupp)

Indiana - Temperature favorable to injury; July 3; throughout northern section of state. (Gardner & Gregory)
Washington - (Dana)

Winter injury, cause physiological
Ohio - one report; May 11; Stark County. (Detmers)

MULBERRY (Morus alba)
Sclerotinia carunculoides Siegler & Jenkins
South Carolina - Scranton, March. Coll. Siegler, E. A. (PHN5)

OAK, WHITE (Quercus alba)
Powdery mildew caused by Microsphaera alni (Wallr.) Salm.
Pennsylvania - general; quite severe on this host, more so than on Castanea. causing deformation of terminii of shoots and leaves. (Overholts)

Anthracnose caused by Gnomonia veneta (Sacc. & Speg.) Kleb. =(G. canadense) Ell. & Ev.)(G. nervisequum (Fckl.) Sacc.)
New York - (Collins)
Pennsylvania - causing marked necrotic areas on leaves, particularly along the veins; mature conidia, June 6. (Overholts)
Iowa - common (Melhus)

Witches broom caused by Microstroma album (Desm.) Sacc.
West Virginia - no increase in the number of brooms on the tree reported in 1920 at Morgantown. (Sheldon)

Sap rot caused by Stereum sp.
Ohio - local and severe; base of an important oak badly diseased; tree surgery suggested as a means of control. (Scherer)

OAK, SCARLET (Quercus coccinea)
Armillaria root rot caused by Armillaria mellea (Vahl.) Quel.
Minnesota - (Sect. Pl. Path.)

European canker caused by Nectria galligena Bres.
Oregon - Zeller and Owens. Phytopath. 12: 105. Feb. 1922.

Butt rot, cause undetermined
New York- a very pronounced butt rot of scarlet oak which gives a sort

of whitish pocketed or piped-rot appearance to the interior of the cut stumps; sap wood was apparently not affected. This has caused a great deal of loss in the timber since it affected the basal part of the trunk for five or six feet up. (Graves)

OAK, WATER (Quercus nigra)

Leaf blister caused by Taphrina coerulescens (D. & M.) Tul.

Florida - reported to be severe at St. Augustine. (Burger)

OAK, CHESTNUT (Quercus prinus)

Leaf spot caused by Marssonia martini Sacc. & Ell.

Pennsylvania - local; causing a moderate amount of damage; as long as the rounded spots remain isolated their centers are occupied by a single acervulus. (Overholts)

Diplodia suberina Dur. & Mont.

Pennsylvania - Bethlehem - collected by B. O. Dodge. (PHN5)

Physalospora cydoniae Arnaud. = (Sphaeropsis malorum Pk.)

New York - (Collins)

OAK, RED (Quercus rubra)

Sapwood rot caused by Polystictus pergamenus Fr.

Ohio - local; severe; treatment recommended is removal of all diseased wood and the treatment of wound. (Scherer)

Red heart rot caused by Polyporus sulphureus (Bull.) Fr.

Ohio - local; severe. (Scherer)

Mildew caused by Oidium sp.

New Hampshire-during the wet season in New England, several diseases of the wet weather type were more prevalent than for some years previously; a mildew was very abundant on red oak in the White Mountains of New Hampshire; I have not noted it in previous summers; it was not doing much damage. (Snell)

OAK (Quercus spp.)

Leaf blister caused by Taphrina coerulescens (D. & M.) Tul.

Massachusetts - rather common; generally distributed throughout state. (Osmun) Severe at Beverly Farms. (Scherer)

New York - general and severe on Long Island. (Scherer)

Connecticut - three reports; new trouble to state; June 30; Fairfield and Tolland Counties. (Clinton)

South Carolina - about the same amount of prevalence as in 1921; unimportant; found in western part of state; May 5. (Ludwig)

Leaf blister caused by Taphrina sp.

Louisiana - not T. coerulescens, but resembles it. (Edgerton)

Anthracnose caused by Gnomonia veneta (Sacc. & Speg.) Kleb.

Massachusetts - rather common; general throughout state; often causes serious defoliation of white oak. (Q. alba). (Osmun)

Angelinia rufescens (Schw.) D By
Pennsylvania - Coll. L. O. Overholts. (PHN5)

Red heart rot caused by Polyporus sulphureus (Bull.) Fr.
New Hampshire - fruited abundantly. (Snell)
Rhode Island - abundant fruiting. (Snell)

Powdery mildew caused by Oidium sp.
Louisiana - occasional; small percentage of injury; very slight loss; Apr. 25. (Edgerton)

Powdery mildew caused by Microsphaera alni extensa = (Microsphaera quercina (Schw.) Burr.)

Wilson, Malcolm. The oak mildew. Trans. Roy. Scott. Arbor. Soc. 36: 92-97. July. 1922.

Leaf chlorosis - non parasitic.
Washington - (Dana)

POPLAR, WHITE (Populus alba)
Rust caused by Melampsora abietis-canadensis (Farl.) Ludw.
Oregon - rare and unimportant. (Boyce)

POPLAR, BALM OF GILEAD (Populus balsamifera)
Canker caused by Cytospora chrysosperma (P.) Fr.
Idaho - Hubert. Phytopath. 10: 442. Oct. 1920.

POPLAR, CAROLINA (Populus deltoides)
Canker caused by Cytospora chrysosperma (P.) Fr.
North Dakota - in 1917, while acting state forester, F. W. Smith found this disease to be widespread within the state; P. deltoides is affected throughout the state; it was noticed that the attack of the pathogen is particularly bad where trees had been injured by bruising, such as by hailstorms, etc.

Rust caused by Melampsora medusae Thüm.
Illinois - July 3, at Cave-in Rock, Hardin County. (Tehon)
North Dakota - more than last year; very common, Aug. 30. (Weniger)

POPLAR, LARGE TOOTH ASPEN (Populus grandidentata)
Trametes suaveolens Fr.

Murrill, W. A. A fragrant polypore. Mycologia 14: 46-47. 1922.

POPLAR, LOMBARDY (Populus nigra italica)
Canker - cause unknown
New York - reported June 13 from Oneida County. (Chupp)
North Carolina - reported Mar. 6 from Aiken County. (Ludwig)

POPLAR, QUAKING ASPEN (Populus tremuloides)

Canker caused by Cytospora chrysosperma (Pers.) Fr.
North Dakota - (Smith, Fred W.)
South Dakota, Montana and Idaho - (Hubert. Phytopath. 10: 442. Oct. 1920)

Tar spot caused by Sclerotium bifrons Ell. & Ev.
Oregon - found to quite an extent; causes little injury to the host. (Boyce)

Powdery mildew caused by Uncinula salicis (DC.) Wint.
British Columbia - normally causes little damage. (Boyce)

Leaf rust caused by Melampsora albertensis Arth.
Idaho and British Columbia - common but does little damage. (Boyce)

Fomes igniarius (L.) Fr.

Meinecke, E. P. Pathology of quaking aspen in Utah in relation to regulation. (Abstract) Phytopath. 12: 446. Sept. 1922.

POPLAR, BLACK COTTONWOOD (Populus trichocarpa)

Canker caused by Cytospora chrysosperma (P.) Fr.
Montana, Washington and Idaho - (Hubert. Phytopath. 10: 442. Oct. 1920)

Yellow leaf blister caused by Taphrina aurea (Pers.) Fr.
Oregon - widespread but causes little injury. (Boyce)

Powdery mildew caused by Uncinula salicis (DC.) Wint.
British Columbia - occurs occasionally, little injury. (Boyce)

Leaf rust caused by Melampsora occidentalis Jackson
British Columbia - widespread in range but normally does little damage. (Boyce)

Gall caused by Macrophoma tumefaciens Shear

Reference

Hyde, Karl C. Anatomy of a gall on Populus trichocarpa. Bot. Gaz. 74: 186-196. Pl. VI. O. 1922. no. 2.
Infection experiments on pathogenicity are as yet lacking.

POPLAR (Populus spp.)

Canker caused by Cytospora chrysosperma (Pers.) Fr.
North Dakota - 40% of the stock in one nursery was found to be infected; September; disease not common to state. (Lonigen)
Colorado - (Isern)
Arizona - common throughout state. (Brown)
Idaho - causes considerable damage to poplars in various parts of the state. (Hungerford)

Reference

Moss, E. H. Observations on two poplar cankers in Ontario. Phytopath. 12: 425-427. Sept. 1922.

Delacroix, Georges. Sur une maladie du peuplier de la Caroline. Bull, Soc. Mycol. France. 22: 239-252. 1 pl. 1906.

Brown, J. G. Cytospora canker, a disease destructive to cottonwoods and poplars, Arizona Sta. Timely Hints for Farmers, No. 138 (1922), pp. 4, figs. 2.- A description is given of a serious disease of cottonwoods and poplars due to C. chrysosperma, which has appeared in the southwestern part of the United States. Differences in susceptibility to fungus attack are pointed out, and for control the planting of resistant varieties is recommended, as well as providing proper drainage and giving careful attention to pruning.

A canker similar to that caused by Cytospora chrysosperma was reported by Walter H. Snell as being very prevalent in poplars in the White Mountains of New Hampshire, especially on the northside of the Presidential range and that many stands of poplar are being ruined by this trouble, many trees are dead, many broken over while others are stagheaded.

European canker caused by Dothichiza populea Sacc. & Br.

Connecticut - increasing in prevalence; present in most of the nurseries; 32 reports from 5 counties during year; nursery inspectors look out for this and break the infected trees. (Clinton)

Pennsylvania - (Orton and Thurston)

Ohio - average amount of prevalence; severe locally; Norway poplar especially susceptible; period of greatest injury during June and August; June. (Detmers)

Wisconsin - more prevalent; killing all Lombardy poplars in northwestern section of state; reported by white-pine blister rust scouts. (Vaughan)

Reference

Hedgcock, G. G. and N. R. Hunt. Dothichiza populea in the United States. Mycologia. 8: 300-308. Pl. 194-195. 1916. Lit. cited p. 308.

Rust caused by Melampsora medusae Thüm.

South Carolina - unimportant. (Ludwig.)

Melampsora sp.

Iowa - common. (Melhus)

Anthracnose caused by Marssonia populi (Lib.) Sacc.

New Hampshire - July 16 at Woodsville, Grafton County.

Anthracnose caused by Marssonia sp.

West Virginia - a serious disease of trees planted for shade in Morgantown. August 9. (Sheldon)

Leaf spot caused by Phyllosticta sp.

Arizona - common. (Brown)

Powdery mildew caused by Uncinula salicis (DC.) Wint.

Delaware - much more than last year and more than the average year.(Adams)

Iowa - common. (Melhus)

Wood rot caused by Favolus salicis (DC.) Wint.
Minnesota - saprophytic (Sect. Pl. Path.)

Polyporus inzeugae Ces. & DeNot.
Biers, P. M. Le Polyporus (Ungulina) inzeugae. DeNot. parasite du peuplier. Bull. Soc. Path. Veg. Trana. 9: 166-168. July and September. 1922.

SASSAFRAS (Sassafras spp.)
Leaf spot caused by Gloeosporium affine E. & K.
Illinois - common in southwestern part of state; July 17; range of disease is evidently not co-extensive with range of the host in state. (Tehon)

SERVICE BERRY, WESTERN (Amelanchier alnifolia)
Witches broom caused by Fusicladium sp.
Washington - (Dana)

Nectria disease caused by Nectria cinnabarina (Tode) Fr.
Washington - (Dana)

Leaf spot and witches brooms caused by Dimerosporium collinsii (Schw.) Thüm.
Idaho, Washington, British Columbia. - Perennial witches brooms are formed, not uncommon; injury slight.(Boyce)

Powdery mildew caused by Phyllactinia corylea (Pers.) Karst.
British Columbia - though common causes little damage. (Boyce)

Rust caused by Gymnosporangium nelsoni Arth.
British Columbia - sometimes found, little injury to host. (Boyce)

Rust caused by Gymnosporangium kernianum Bethel
Oregon - occurs occasionally; little injury to host. (Boyce)

Rust caused by Gymnosporangium harknessianum (E. & E.) Kern.
Oregon - results in considerable hypertrophy of the leaves, stems and fruits on infected bushes. (Boyce)

SERVICE BERRY (Amelanchier sp.)
Fire blight caused by Bacillus amylovorus (Burr.) Trev.
Washington - found to some extent; believed it would be necessary to remove the native host plants before the disease can be effectively controlled. (Mills)

SYCAMORE (Platanus occidentalis)
Anthracnose caused by Gnomonia veneta (Sacc. & Speg.) Kleb. = (Gloeosporium nervisequum (Fckl.) Sacc.)
Massachusetts - rather more than usual and caused a very serious defoliation. (Osmun)
Connecticut - average amount, June 20. (Clinton)
New York - quite severe in the spring; of general prevalence. (Henn)

West Virginia - (Sheldon).
Illinois - (Collins)

Powdery mildew caused by Microsphaera alni (Wallr.) Salm.
District of Columbia - (Collins)
Ohio - less than usual; May 31; moderately important. (Detmers)
Indiana - May 17. (Gardner)
Illinois - of average prevalence; of considerable importance; 25% infection in state; June 6. (Tehon)
Iowa - general in southern part of state. (Melhus)
California - this will be a serious disease if it spreads to any extent as the sycamore is one of the best trees in California; the springs of 1921 and 1922 were worst; Bordeaux mixture recommended as a control. (W. Metcalf)

Recent literature
Enfermedad de los platanos. Bol. Mens. Defensa Agr. Uruguay. 3: 20-21. F. 1922. no. 2.

Drought injury
Washington - (Dana)

Winter killing -
New York - another source of trouble with this tree has been winter killing. It would attain a diameter of six inches and die during a cold winter. It is my belief that Albany is situated beyond the northern range of this tree so we have replaced the oriental plane with other species. (Whaley)

Canker - undetermined.
Wisconsin - cankers on main trunk of eight trees in a nursery. (Vaughan)

New York - In Albany considerable trouble has been caused at times by a canker which would form on the trunks of young trees (2 to 4 inches in diameter) and in a wind storm the tree would break off at the point of attack. (Whaley)

WALNUT - (Juglans spp.)
Leaf spot caused by Gnomonia leptostyla (Fr.) Co. & De Not. Syn.=(Marssonia juglandis (Lib.) Sacc.
Connecticut - becoming more prevalent; June. (Clinton)
Delaware - tree was nearly defoliated on account of this disease.(Martin)
Illinois - probably throughout state; caused serious local defoliation; June 23. (Tehon)

Melanconium oblongum Berk.
New York - (Collins)

WILLOW - Salix spp.
Rust caused by Melampsora bigelowii Thum.
Illinois - average amount of prevalence; slightly important; 50% of plantings in state infested; probably ranges throughout state. Aug. 1. (Tehon)

British Columbia - common but causes little injury. (Boyce)

Melampsora sp.
Colorado - (Learn)
Idaho - common. (Hungerford)

Amphisphaeria decolorans (Rehm)
North Dakota - (PHN5)

Crown gall caused by Bacterium tumefacians EFS. & Town.
Connecticut - caused no particular injury. (Clinton)

Canker caused by Cytospora chrysosperma (Pers.) Fr.
Wyoming, Montana, Idaho, and Washington - (Hubert. Phytopath. 10:443. Oct. 1920)

Tar spot caused by Rhytisma salicinum Fr.
British Columbia - striking but of no economic importance. (Wint.)

Powdery mildew caused by Uncinula salicis. (DC.) Wint.
British Columbia - causes trifling damage. (Boyce)

White heart rot caused by Fomes igniarius (L.) Gill.
Idaho - is of little importance. (Boyce)

European canker caused by Nectria galligena Bres.
Oregon -(Zeller and Owens. Phytopath. 12: 105. Feb. 1922).

Trametes suaveolens Fr.

Recent literature
Murrill. W. A. A fragrant polypore. Mycologia 14: 46-47. 1922.

Leaf blotch caused by an organism similar to Phyllosticta sp.
West Virginia - J. L. Sheldon. Aug. 9, 1922.
"For several years I have been studying a disease of black willow twigs which in general resembles the blotch of apple twigs in the vicinity of Morgantown. The fungus grows readily in culture media and I have secured a few spores. The spores are so much like those of the apple blotch fungus that I am not certain I can tell them apart; they are, of course, much like those of the leaf spots of grape and ampelopsis. I have repeatedly found the apple blotch fungus within a few feet of the diseased willows. No inoculations have been made."

WITCH HAZEL (Hamamelis virginiana)
Leaf spot caused by Phyllosticta hamamelidis Cke.
Pennsylvania - pycnidia entirely empty of spores by July 15; very severe in district around Seven Mountains. (Overholts)

AMPELOPSIS (Ampelopsis quinquefolia)

Leaf spot caused by Guignardia bidwellii (E.) V. & R. = (Phyllosticta ampelopsidis)

Rhode Island - (Collins)

Connecticut - more prevalent, reported from the southwestern section of state. (Clinton)

New York - very common, found over state wherever five-leaf ivy is grown. (Chupp)

Delaware - much more than in previous years and more than the average year. (Adams)

West Virginia - a small amount on both wild and cultivated plants near Morgantown, also found on wild plants near Granville. (Sheldon)

Illinois - the importance of this disease on this host is that it acts as a source of infection for the cultivated grape. It probably ranges throughout the state. (Tehon)

Minnesota - reported from several counties in vicinity of Ramsey County; nature of injury is many leaf spots; some injury to the berries was observed only in east central part of state, mainly on vines not under cultivation. (Sect. of Pl. Path.)

Powdery mildew caused by Uncinula necator (Schwein.) Burr. = (U. ampelopsidis Pk.)

Minnesota - observed only in Scott County. (Sect. Pl. Path.)

Additional states reporting presence of disease in previous years are Massachusetts, New Jersey, Pennsylvania, Maryland, Indiana, and Nebraska.

AMPELOPSIS (Ampelopsis tricuspidata)

Leaf spot caused by Guignardia bidwellii (E.) V. & R.

Massachusetts - more than ordinarily abundant; generally distributed. (Osmun)

Connecticut - becoming more prevalent; most damage is to the foliage, the vines being killed prematurely. (Clinton)

West Virginia - very abundant and destructive to recent growth of host at Morgantown. Seems to be worst on the young runners on tops of walls. (Sheldon)

ASPARAGUS FERN (Asparagus plumosus)

Fusarium sp.

Florida - (Burger)

Phoma sp.

Florida - (Burger)

Physarium sp.
Florida - one specimens of a dying plant sent in was nearly covered with this myxomycete. (Burger)

ASTER, CHINA (Callistephus chinensis)
Wilt caused by Fusarium conglutinans callestephi Beach.
Reported present in N. H., Vt., N. Y., Ohio, Ind., Mich., N. Dak., Ida., and Wash. Has also been found in previous years in Virginia, Illinois, Minnesota, and Oregon.

Vermont - relative prevalence very much above the average; important to commercial growers; the wet weather in June contributed to the early seed bed infection. (Lutman)
Ohio - less prevalent than in 1921. Time of greatest injury is when it attacks the host at the transplanting period. Found in northern and central part of state; unfavorable moisture conditions were existent during latter part of season; temperature conditions were most favorable. (Detmers)
Indiana - worse than in previous years; very serious; reported from northern half of state, drouth and high temperature are favorable for wilt. (Gardner)
Michigan - reported by several householders as serious in small beds. (Coons)
North Dakota - apparently the only limiting factor in growing of asters in garden plots in the state; known to occur in northern, central and eastern parts of state. (Weniger)
Idaho - fairly common, being reported from various sections in state. (Hungerford)

Rust caused by Coleosporium solidaginis. (Schw.) Thüm.
Reported from New York and Louisiana. (Very severe in cultivated asters, killing many of the plants. (Edgerton)

Yellows, cause undetermined.
New Hampshire (Butler) and Delaware (Adams)

Philospora sp.
Florida - an aster plant received from Tampa was badly affected, the leaves had small brown spots in them, the correspondent wrote that the whole stock was badly affected with the disease. (Burger)

BACHELORS BUTTON (Centaurea cyanus)
Rust caused by Puccinia centaureae Mart.
District of Columbia - one plant of 24 affected; stem and leaves of plant completely covered by sori. (Martin)

BARBERRY (Berberis sp.)
Leaf spot - causal organism bacterial.
Idaho - throughout state wherever barberries are grown. (Hungerford)

BEGONIA (Begonia sp.)

Nematodes

Ohio - reported from Clark County. (Detmers)

BOX, (Buxus sempervirens)

Macrophoma candollei (Berk. & Br.) Berl. & Vogl.

New Jersey, Maryland - (Collins)

Volutella buxi Berk.

New Jersey, Maryland - (Collins)

CALLA LILY (Zantedeschia sp.)

Soft rot caused by Bacillus caratovorus or aroideal

New York (Massey & Chupp), Pennsylvania (Orton), and Indiana - serious in greenhouse. (Gardner)

Reference: Bewley, W. F. Report of the Mycologist Ann. Rept. Exp. and Res. Sta. Nursery & Market Garden. Industr. Dev. Soc. 7(1921): 32-41. 1922.

CAMELLIA (Camellia japonica)

Leaf spot caused by Pestalozzia inquinans C. & Hark.

South Carolina (Ludwig.)

Leaf spot caused by Didymella (?) sp.

South Carolina (Ludwig)

CARNATION (Dianthus caryophyllus)

Rust caused by Uromyces caryophyllus (Schw.) Wint.

Reported from Connecticut, New York, Ohio, Indiana, Illinois, Minnesota, and Colorado. In most cases it is chiefly a greenhouse disease.

Stem rot and wilt caused by Fusarium sp.

New York - found in a greenhouse at Bulls Head, Staten Island. (Massey)

Pennsylvania - in greenhouse and field causing 50% or more loss. (Orton and Thurston)

Florida - specimens were received from Pensacola which were badly infected. (Burger)

Ohio - (Detmers)

Root knot caused by Heterodera radicicola (Greef) Müller.

South Carolina - the plants were propagated out of doors in infested soil and later when the plants were brought into the college greenhouse they did very poorly. (Ludwig)

Ohio - first report. (Detmers)

Alternariose caused by Alternaria dianthi S. & H.

New York - severe in several greenhouses causing considerable loss. (Massey)

Previous reports from Connecticut, Pennsylvania, Maryland, North Carolina and Minnesota.

Chlorosis, cause unknown
Ohio - first report, general and throughout state, considerable in greenhouses, causing spotting of foliage and general debility. (Detmers)

White tip - probable cause fumigation with tobacco preparations.
Connecticut - one report. (Clinton)

CHRYSANTHEMUM (Chrysanthemum hortorum)
Powdery mildew caused by Erysiphe cichoracearum DC.
Delaware - local in distribution: prevalent in greenhouse propagation; small pom-pom varieties very susceptible. (Adams)

Leaf spot caused by Septoria chrysanthemi Cav.
Texas - trace (Taubenhaus)

COTONEASTER (Cotoneaster horizontalis)
Phyllosticta horizontalis
North Carolina - (Collins)

DAHLIA (Dahlia spp.)
Powdery mildew caused by Erysiphe cichoracearum DC.
West Virginia - slight, probably occurring too late to be of any importance. (Sheldon)

Root rot caused by Pythium debaryanum Hesse
Connecticut - little injury, local. (Clinton)

Root knot - caused by Heterodera radicicola (Greef) Müller.
California - general and widespread in Los Angeles Co. (Fields)

Recent literature
Essig, E. O. Nematode attacking dahlia tubers. Month. Bull Dept. Agr. Calif. 11:465-466. May. June. 1922.

Wilt caused by Bacterium solancearum EFS.
North Carolina - See COSMOS. Wolf, F. A. Additional hosts for Bacterium solancearum. Phytopath. 12: 98-99. Feb. 1922.

Mosaic or yellows caused probably by an obscure physiological trouble.
Connecticut - three reports, one grower reporting a 30% loss and that the trouble has continued to progress during the last few years. (Clinton)

DIGITALIS PURPUREA
New abnormality

Recent literature
Pater, B. Eine neuere abnormitaten Digitalis purpurea L. Zeitschr. Pflanzen 32: 97-102. illus. 1922.

CLEMATIS (Clematis virginiana)
Rust caused by Puccinia agropyri Ell. & Ev. (Puccinia clematidis Lagh.)
Minnesota - one report (Sect. Pl. Path.)

COSMOS (Cosmos sp.)
Wilt caused by Bacterium solancearum EFS.
North Carolina - specimens from a garden in Raleigh, August, 1921, tops of plants show sudden wilting and dropping; may recover temporarily during night, but after several days leaves shrivel, become dry and remain attached to plant, which ultimately dies. Wolf, F. A. Additional hosts for Bacterium solancearum. Phytopath. 12: 98-99. Feb. 1922.

EVONYMUS Evonymous atropurpurea)
Powdery mildew caused by Microsphaera alni (Wal.) Salm.
Illinois - about a 25% affection is found in the state. Tehon

EVONYMUS, JAPANESE (Evonymus japonicus)
Powdery mildew caused by Oidium evonynui japonici (Arc.) Sacc.
Louisiana - common in northern part of state; first report of this trouble in the United States. Collected at Shreveport, Caddo Parish in April; also collected in Bossier Parish; earliest reported appearance, March 18. (Edgerton)

EVONYMOUS spp.
Anthracnose caused by Gloeosporium sp.
Texas - prevalent. (Taubenhaus)

Leaf spot caused by Exosporium concentricum. Heald & Wolf.
Texas - prevalent (Taubenhaus)

FLOWERING CRAB (Pyrus spp.)
Rust caused by Gymnosporangium juniperi-virginianae Lk. (Roestelia pyrata Thaxt.)
Connecticut - locally little injury. (Clinton)
Indiana - local (Gardner)

FUCHSIA (Fuchsia sp.)
Mosaic caused by physiological factors.
Connecticut - on greenhouse plant affected at New Haven; cuttings from the mosaic stem came mosaiced; others from healthy stems of same plants came healthy but inoculation experiments failed. (Clinton)

GERANIUM (Pelargonium sp.)
Bacterial leaf spot caused by Bacterium erodii Lewis
Connecticut - becoming more prevalent, very bad at Storrs in a flower-bed; this disease has been noticed once or twice before but this is the first time that it was definitely determined as a bacterial disease. (Clinton)

Indiana - worse than in previous years; destructive locally; occurred in a greenhouse and later in a garden; the causal organism was isolated. (Gardner)

In 1903 G. E. Stone (Mass.) reported a bacterial blight as having been common that summer; at that time it was apparently increasing and spreading throughout the United States. As early as 1898, attention had been called to this disease by Stone. From that time on it has been growing more and more common each year and becoming more widely disseminated.

In 1909 Norton (Md.) reported a leaf spot in the geranium supposedly caused by bacteria. Selby (Ohio) in 1911 reported a bacterial disease on this host, commenting then that it required study.

According to Lewis[1], Heald and Wolf reported the bacterial disease in the vicinity of San Antonio, Texas, in 1912. E. L. Jenson (Minn. 1916) found bacterial leaf spot, cause not determined, to be moderately severe in greenhouses. Both Ohio and Minnesota reported its occurrence again in 1916 and in 1917 Selby and Heald reported leaf spot and bacterial blight as caused by Bacterium (Pseudomonas) erodii as occurring in Ohio and Idaho respectively. Again in 1918 it was reported by Selby and Heald, the latter reporting this time its occurrence in Washington. In 1912 Clinton (Conn.) and Gardner (Ind.) reported it worse than in previous years; in Connecticut it is becoming more prevalent, and also that it had been noticed once or twice before but had not therefore been definitely determined.

Literature

(1) Lewis, I. M. A bacterial disease of Erodium and Pelargonium. Phytopath. 4: 221-231. 1914.

Stone, G. E. Bacteriosis of geranium. Ann. Rep. Massachusetts Agr. Exp. Sta. 19: 164. (1905/06)

Leaf spot caused by Botrytis sp.

First reports to the Plant Disease Survey were received in 1908 from J. B. S. Norton of Maryland, at which time he found it at Baltimore and College Park; he reports it again in 1909. A single instances was noted by G. H. Coons (Mich.) in a greenhouse in Joseph County during 1913. No further reports were made to this office until 1920 when L. E. Melchers (Kansas) reported it as occurring in several counties and that a distinct blight to the flowers and a leaf spot of the foliage occurred, also that investigations at that time showed the causal organism similar, if not the identical species causing lettuce head mold, and that cross inoculations had verified it. The same year Selby (Ohio) reported green mold in Madison County. Again in 1921 this trouble was reported from Ohio and Kansas; in the latter state it was quite serious. Melchers (Kans.) reported a moderately severe local occurrence again in 1922.

Reference

Melchers, L. E. Botrytis sp. causing severe injury to flowers and foliage of Pelargonium hortorum. Phytopath. 8: 76. 1918.

Dropsy - physiological
Ohio - general throughout state; chiefly in greenhouses, seen to some extent outside. (Detmers)

In 1909 Selby (Ohio) reported this somewhat general in distribution over the state and that the trouble was caused by over-watering and in 1910 suggested as treatment a regulation of the water supply. Its occurrence has been reported from Ohio each succeeding year up to and including the present, where it is usually found in the greenhouses although it has been seen in outside gardens.

GLADIOLUS (Gladiolus sp.)
Fusarium rot caused by Fusarium sp.
New York - a storage rot, found in experiment plantings at Ithaca. Doubtless occurred in practically all plantings in state. (Massey)
Ohio - first report of this disease for state; nature of injury is that it forms scabs on cor and impairs vigor; Brenchleyensis variety most susceptible. (Detmers)

Dry rot caused by Sclerotium sp.
New York - a storage rot found in corms from experimental plantings at Ithaca; doubtless occurs in all plantings in state. (Massey)

Sclerotinia dry rot caused by Sclerotinia sp.
Ohio - first report from state; causes a rotting of corms; the variety "War" apparently very susceptible. (Detmers)

Hard rot caused by Septoria gladioli Pass.
New York - storage rot; premature death of plants. (Massey)
Indiana - (Gardner)

Leaf blight, cause uncertain.
Washington - (Dana)

GOLDEN GLOW (Rudbeckia laciniata)
Powdery mildew caused by Erysiphe cichoracearum DC.
Connecticut - appeared August 6 at Westville, New Haven County. (Clinton)
West Virginia - abundant in several yards about Morgantown. (Sheldon)

HELLEBORE (Helleborus niger.)
Coniothyrium hellebori Cke. & Mass.
Oregon - PHN5)

HIBISCUS - (Hibiscus sp.)
Rust caused by Puccinia malvacearum Mont.
Montana - 100% local infection. (Christopher)

HOLLYHOCK (Althea rosea)
Rust caused by Puccinia malvacearum Mont. = (Micropuccinia malvacearum (Bertero) Arth. & Jackson)
Reported from Vermont, New Hampshire, Massachusetts, Connecticut, New York,

Indiana, Colorado and Arizona
Vermont - average amount; 75% crop injury; loss insignificant; interesting to note that in spite of wet June the rust was not more abundant than usual. (Lutman)
Massachusetts - about usual amount, general in range; an evident varietal resistance. (Osmun)
New York - average amount and very important. (Massey)
Ohio - more reports than in 1921; favorable weather conditions in June. (Detmers)
Colorado - unimportant; moisture conditions below normal, temperature above normal. (Learn)
Arizona - Snowflake only variety resitant. (George)

Root rot caused by Ozonium omnivorum Shear
Texas - fairly important - about a 5% reduction. (Taubenhaus)

Leaf spot caused by Cercospora althaeina Sacc.
Delaware - found in September at Newark, New Castle County. (Adams)

Ascochyta sp.
West Virginia - very abundant in two yards at Morgantown, the foliage of the plants being nearly destroyed. (Sheldon)

HYDRANGEA (Hydrangea hortensia)
Leaf spot caused by Phyllosticta hydrangea Ell. & Ev.
South Carolina - Florence County, May 27. (Ludwig)

IMPATIENS BALSAMINA
Rust caused by Puccinia impatientis Arth.
Illinois - found in Hamilton, Jefferson and Wayne Counties. (Tehon)

IRIS (Iris spp.)
Leaf spot caused by Didymellina iridia (Desm.) Von, H. = (Heterosporium gracile) (Wal.) Sacc.
Reported from Connecticut, New York and Minnesota.

Soft rot caused by Bacillus carotovorus Jones
Connecticut - average amount. (Clinton)
Minnesota - produces a soft rot of the rhizomes; observed only in Ramsey County; very high humid weather conditions; one acre field on low, wet land practically a total loss; organism was isolated from diseased tissue and was found to rot vegetables readily. (Sect. Pl. Path.

KENTIA BALMOREANA
Colletotrichum kentiae Halsted
New Jersey - South Orange. (PHN5)

KUDZU (Pueraria thunbergiana)
Leaf spot - cause undetermined
Kentucky - (Valleau)

LARKSPUR (Delphinium sp.)
Blight caused by Bacterium delphinii EFS.
Connecticut - three reports; a rather serious trouble when present. (Clinton)

Wilt - caused by Fusarium sp.
Florida - this disease was reported from Duval County where it was said to be serious in a certain estate. (Burger)

LAUREL - (Laurus nobilis)
Gloeosporium nobili
New Jersey -(Collins)

LAUREL (Laurus sp.)
Sphaeropsis sp.
South Carolina - (Collins)

LAVENDER (Lavandula sp.)
Pholiota praecox (Pers.) Quelet

Literature:
Chevalier, Auguste. Sue une maladie de la lavande cultivée. Rev. Bot. Appl. 2:482-483. Sept. 1922.

LILAC (Syringa spp.)
Powdery mildew caused by Microsphaera alni (Wallr.) Salm.
Reported from Connecticut, Delaware, Ohio, Illinois, Minnesota, Iowa, and California. (See map for distribution in United States)

LONICERIA TARTARICA
Powdery mildew caused by Microsphaera alni var. lonicerae (DC.) Salm.
Minnesota - observed only in Scott and Blue Earth Counties. (Sec.Pl.Path)

LUPINE (Lupinus spp.)
Powdery mildew caused by Erysiphe polygoni DC.
Idaho, Oregon - common but of no importance. (Boyce)

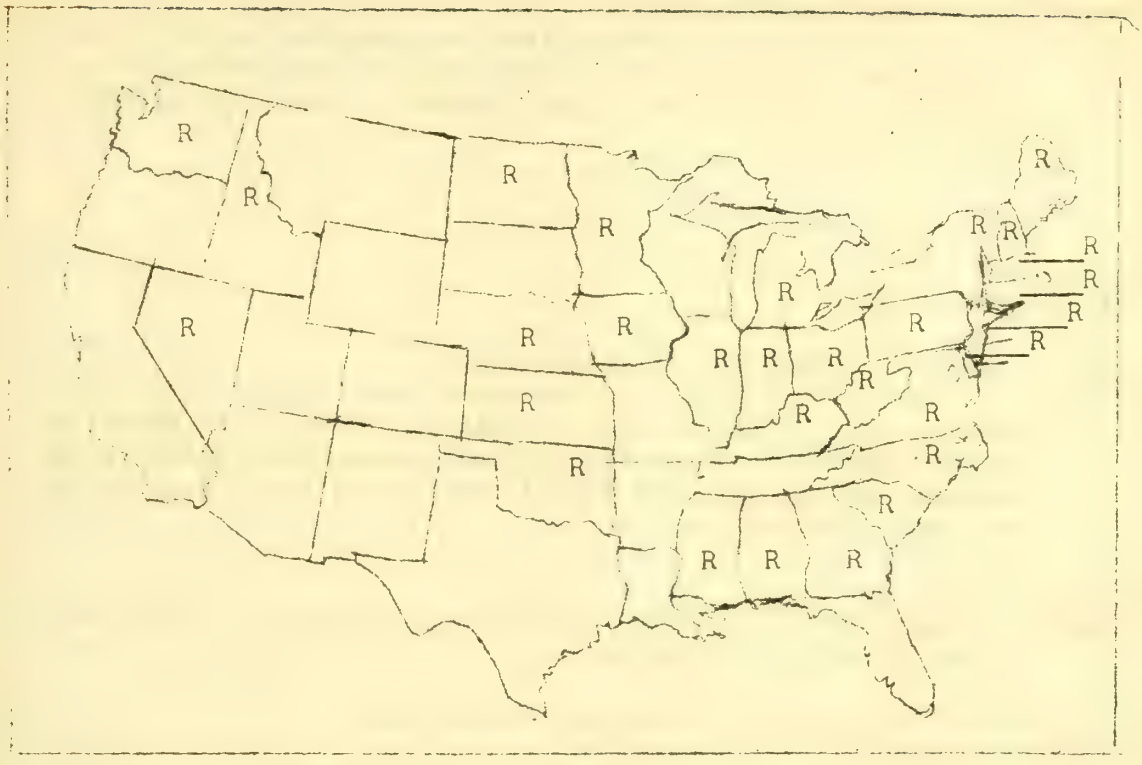

Fig. Geographical distribution of Microsphaera alni on Syringa spp. in the United States as reported to the Plant Disease Survey.

MATRIMONY VINE (Lycium sp.)

Powdery mildew caused by Erysiphe polygoni DC.

Delaware and West Virginia (100% infection - caused defoliation. (Sheldon)

Rust caused by Puccinia lycii Kalchbr.

Ohio - (Detmers)

MONARDA (Monarda sp.)

Coleosporium narcissi Grove

Literature:

Grove, W. B. Coleosporium narcissi sp. n. Journ. Bot. 60: 121-122. Apr. 1922. no. 712.

OCEAN SPRAY (Holodiscus discolor)

Powdery mildew caused by Podosphaera oxyacanthae (DC.) deBy

Idaho - rare; does little damage.(Boyce)

OSAGE ORANGE (Maclura pomifera)

Rust caused by Physopella fici (Cast.) Arth.

Reported in former years in Louisiana, also an additional report in North American Flora 7^2:103.

OXALIS (Oxalis sp.)

Rust caused by Aecidium oxalidis Schw.

Florida - this disease was reported from two sections of the state, Palm Beach and Bradentown. Since this is the aecidial stage of the corn rust, it is of great economic importance in the state. (Burger)

PALM

Alternaria sp.

Florida - (Burger)

Leaf spot caused by Exosporium palmivorum Sacc.

Texas - a serious leaf spot of green-house grown palms; seems to be serious only if potted palms remain too long in the shade; by cutting off the diseased foliage and placing the plants to the exposure of sunlight and ventilation, the disease seems to be checked. (Taubenhaus)

Gloeosporium sp.

Florida - found on the fish-tail palm and was said to be doing considerable damage. (Burger)

False smut caused by Graphiola phoenicis (Mong.) Poit.

Florida - quite abundant. (Burger)

Louisiana - common, caused a slight loss. (Edgerton)

Leaf blight caused by Pestalozzia palmarum Cke.

Texas - infection with the causal fungus invariably takes place at axil of the leaf; the fungus may be readily grown in pure culture and artificial inoculations carried out. (Taubenhaus)

Pestalozzia sp.

Florida - common. (Burger),

Recent literature

La Rue, Carl D. and H. H. Bartlett. A demonstration of numerous distinct strains with the nominal species Pestalozzia guepini Desm. Amer. Jour. Bot. 9: 79-92. Sumatra, Feb. 1922.

PANSY (Viola tricolor)

Rust caused by Puccinia violae (Schum.) DC.

North Dakota - (Woniger)

Powdery mildew caused by Sphaerotheca humuli (DC.) Burr.

Washington - (Dana)

PEONY (Paeonia officinalis)

Blight, bud rot and leaf spot caused by Botrytis spp.

Has been observed in past five years in New Hampshire, Massachusetts, Rhode Island, New York, New Jersey, Pennsylvania, Ohio, Indiana, Michigan, Minnesota, Utah, Idaho, and Washington.

New York - prevalent in practically all plantings. (Massey)

Ohio - more prevalent than in 1921; rots stems and leaf bases; rather general over state; greatest damage from May to July when the host is in leaf; weather relations during past year very favorable to disease. (Detmers)
Indiana - serious locally. (Gardner)
Minnesota - usual amount of prevalence; causes brown rot on stems at soil line on buds, leaves and young branches; observed only in Ramsey and Stevens Counties. Injury develops very rapidly on days when the temperature is high and the atmosphere humid. (Sect. Pl. Path.)

Leaf spot caused by Cladosporium paeoniae Pass.
Ohio - one report; causes discoloration of leaves. (Detmers)

Bud rot caused by Phytophthora sp.
Kansas - one report May 17 at Shawnee. (White)

Rot caused by Sclerotinia sp.
Ohio - reported from Cuyahoga County, June 9. (Detmers)

Root knot caused by Heterodera radicicola (Greef) Müller
Ohio - causes a root infection. (Detmers)

PERIWINKLE (Vinca major)
Leaf spot caused by Sphaeropsis vincae
Illinois - produced serious defoliation of greenhouse plants; March 22, 1923 date reported; routine applications of Bordeaux Mixture failed to control the disease; results of specially timed applications were not evident at time of reporting. (Tehon)

PERIWINKLE (Vinca sp.)
Bastard blossom - cause unknown
Texas - affected plants have abnormal proliferated blossoms. (Taubenhaus)

PHLOX (Phlox sp.)
Powdery mildew caused by Erysiphe cichoracearum DC.
Connecticut - more prevalent. (Clinton)
New York - Oneida and Sullivan Counties. (Massey)
Maryland - rather common; little damage except to foliage. (Martin)
West Virginia - very abundant where present in Morgantown; mites caused so much injury that it was difficult to tell about the mildew. (Sheldon)

POINSETTIA (Euphorbia pulcherrima)
Leaf spot caused by Actinonema sp.
Florida - local. (Burger)

PRIMROSE (Primula sp.)
Gray mold caused by Sclerotinia fuckeliana (DeBy) Fckl. = (Botrytis cinerea Pers.)
South Carolina - unimportant in 1922; range in northwest part of state. (Ludwig)

PRIVET, CALIFORNIA (Ligustrum ovalifolium)
Shot hole - cause unknown.
Texas - the disease first appears as tiny minute cracks and spots which later drop out; repeated cultures of the spots failed to yield an organism. (Taubanhaus)

PRUNUS TRILOBA var. PLENA
Fire blight caused by Bacillus amylovorus (Burr.) Trev.

An account of a new host for the fire blight organism in Wisconsin was published this year by Laetitia M. Snow[1]. The new host is an ornamental shrub, Prunus triloba var. plena. The organism was isolated and pathogenicity determined with additional strains of the organism on known susceptible hosts. The importance of this host is concerned with its possibility of wintering over the organism in the vicinity of commercial orchards.

Literature
Snow, Laetitia M. A new host for the fire blight organism, Bacillus amylovorus. Phytopath. 12: 517-524. Nov. 1922.

QUINCE, JAPANESE FLOWERING (Chaenomeles japonica)
Rust caused by Gymnosporangium germinale (Schw.) Kern
Connecticut - new host for this rust in the state; small per cent of affected plants. (Clinton)

RHODENDRON (Rhodendron californicum)
Witches broom caused by Exobasidium vaccinii (Fckl.) Wor.
Oregon - common; the perennial, large dense brooms are quite striking in appearance (See Phytopathology 10[5]. Pl. 11. Fig. 3. May 1920). While an entire bush may be badly deformed the disease does not kill the host. It is of no economic importance, but might become so where this shrub was used for economic purposes. (Boyce)

Leaf rust caused by Melampsoropsis piperiana Arth.
Oregon - Not uncommon, injury to host slight. (Boyce)

Leaf spot caused by Cryptostictis sp.
Oregon - not important since the host is not economically valuable. (Boyce)

RHODENDRON (Rhodendron midiflorum)
Witches broom caused by Exobasidium vaccini (Fckl.)
Pennsylvania - (Overholts)

RHODODENDRON (Rhododendron sp.)

Leaf spot caused by Pestalozzia guepini Desm. var. vaccinii Sh.
Delaware - found at Hollyoak, New Castle County, in May. (Adams)

Melampsoropsis rhodeodendri
New Jersey - (Collins)

ROSE (Rosa spp.)

Powdery mildew caused by Sphaerotheca spp.

Powdery mildew which was reported from 23 states, was more prevalent than in past years in Massachusetts, Delaware, West Virginia, Louisiana, Texas, Arkansas, and Ohio. The Ramblers and Dorothy Perkins were affected the most in Massachusetts, Connecticut, Delaware, Louisiana, Arkansas, and Colorado.

Dates of first appearance;

April, Louisiana
" 11, Ohio
May 13, Indiana
May 22, Delaware
May 23, Kansas
May 24, Missouri
June 5, North Dakota
June 12, Connecticut
June 19, West Virginia
June 22, New Hampshire
September 22, Minnesota

Literature

Massey, L. M. Black spot and mildew of roses. Amer. Rose Ann. 1922. p. 77-88.
Seifert, Ein Neues mittel gegen meltau. Garteuw. 26: 175. illus. April 28, 1922. ("Elosal" experiments with Lady Gay and Dorothy Perkins roses)

Leaf blotch caused by Actinonema rosae (Lib.) Fr. = (Diplocarpon rosae Wolf)
Massachusetts, Connecticut, New York, Delaware, West Virginia, South Carolina, Florida, Louisiana, Texas, Ohio, Indiana, Illinois, Missouri, Colorado, Washington, California. Past reports show this disease occurring in practically all the states.

Dates of first appearance:

January, Louisiana
May 20, Missouri
May 31, South Carolina
June 9, Illinois
June 10, Indiana
June 25, Connecticut
July 2, New York
August, Florida
August 4, Ohio
August 9, West Virginia
September, Delaware

Literature

See powdery mildew

ROSE, WILD (Rosa spp.)

Rust caused by Phragmidium rosae-californicae Diet.
Oregon - common; deforms the fruits, stems and young stems of the host. (Boyce)

Leaf rust caused by Phragmidium montivagum Arth.
British Columbia - causes little injury. (Boyce)

Rust caused by Phragmidium spp.
Vermont, Massachusetts, Connecticut, New York, Minnesota, North Dakota, Washington, and Virginia.
Vermont - very common. (Lutman)
Massachusetts - of little importance; general on both greenhouse and hardy varieties. (Osmun)
Connecticut - common on wild species and spreading to cultivated. (Clinton)
North Dakota - becoming more prevelant, general in range; the wild rose is a common weed in the state in grain fields, hence the rose rust attracts some attention. (Weniger)
California - general and widespread on cultivated and wild roses. (Fields)

Rust caused by Earlea speciosa (Fr.) Arth.
Washington - abundant at Pullman. (Dana)

Rust caused by Earlea spp.
North Dakota - (Weniger)

Crown gall caused by Bacterium tumefaciens EFS. & Town.
Massachusetts, Connecticut, South Carolina, and Washington.
Massachusetts - frequent on Manetti stock and greenhouse roses. (Osmun)

Anthracnose caused by Gloeosporium rosae Hals.
South Carolina and Texas.

Canker or cane blight caused by Leptosphaeria coniothyrium (Fckl.) Sacc.= Coniothyrium fuckelii Sacc.)
Texas and Colorado-reported from one Denver greenhouse. (Learn)

Leaf spot caused by Marssonia sp.
Ohio - first report; causes a spotting of leaves - of general state distribution. Unfavorable weather conditions during year for the disease. (Detmers)

Botrytis rot caused by Botrytis sp.
Texas - (Taubenhaus)

Texas root rot caused by Ozonium omnivorum Shear
Texas - prevalent, reducing yield about 1%. (Taubenhaus)

Anthracnose caused by Myxosporium rosae Fckl.
West Virginia - observed only on R. setigera in a planting in Morgantown; caused a defoliation and cane injury. (Sheldon)

Canker caused by Botryosphaeria dothidea Ces. & De Not.

Literature
Bol. Agr. Sao Paulo 23: 84-87. illus. Mar./Apr. 1922.

Mosaic (?)
Texas - a condition resembling mosaic of rose foliage was found by J. J. Taubenhaus in two localities in the state. The disease had all indications of being mosaic although up to the time of the report no inoculation experiments had been definitely carried out to determine the true cause of the trouble.

Chlorosis caused by too much lime.
Texas - prevalent - about 1% reduction in yield was caused. (Taubenhaus)

Winter injury
Washington -(Heald)

SALMON BERRY (Rubus spectabilis)
Leaf spot caused by Septoria rubi West
Oregon - common and of no importance. (Boyce)

SNAPDRAGON (Antirrhinum spp.)
Rust caused by Puccinia antirrhini Diet. & Holw.
Reported in 1922 from Mississippi, New York, Delaware, Florida, Ohio, Indiana, Illinois, Minnesota, Kansas, Colorado, Washington, and California. Those reporting the presence of this disease in their state are Delawae, Florida, Illinois, Minnesota, and Colorado. To date the following states have reported snapdragon rust present during the past years: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, South Carolina, Florida, Texas, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Kansas, Colorado, Arizona, Utah, Washington, Oregon, and California.
Heavy local infection present in Connecticut, Minnesota and California. In Illinois the disease was general throughout the state and local in Florida, Ohio and Indiana; thought to be more widespread than reports indicate, and in Delaware rust was more prevalent than any previous years and much more than in 1921. Certain greenhouse varieties at the Connecticut Station were more susceptible than others; appeared also on greenhouse stock in Ohio, Indiana and Colorado. In Massachusetts the resistant varieties are apparently more generally grown than formerly as shown by the disease not being as serious as in past years.

Earliest reported dates of appearance are as follows:

April 1, Ohio
May 30, Connecticut
June 9, Illinois
July 3, New York and Indiana
July 7, Delaware and Minnesota
August, Colorado
September 8, Kansas

Recent literature

Butler, Ormond Rourke. How to control the snapdragon rust. Florists' Ex. 43: 353. F. 17. 1917.

_____ Field control of the snapdragon rust. Florists' Ex. 48: 951. 1919. Bot. Absts. 4. no. 1. July, 1920.

Doran, William L. Controlling snapdragon rust. Value of copper and sulphur. Florists' Ex. 43: 501. Mr. 3. 1917. Phytopath.

Hockey, J. F. Germination of teliospores of Puccinia antirrhini. Ann. Rep. Quebec Soc. Prot. Plants 13 (1920/21): 54-57. illus. 1921.
Bibliography. p. 57.

Lehenbauer, P. A. Snapdragon rust. Amer. Flor. 55: 865-866. illus. N. 13, 1920. no. 1693.

Pammel, Louis Herman and C. C. Rees. A new rust of economic importance on the cultivated snapdragon. (Abstract) Phytopathology 4: 400. December, 1914.

Peltier, George L. Snapdragon rust. Illinois Agric. Sta. Bul. 221: 535-548. 5 fig. 1919. Bot. Absts. 3. No. 6. June, 1920.

Thurston, Henry Winfred, Jr. Puccinia antirrhini. Phytopathology 9: 330. Aug. 1919. Phytopath. September, 1919.

Anthracnose caused by Colletotrichum antirrhini Stewart

Delaware (Adams), Ohio (first report for state, attacked greenhouse plants. (Detmers)

Previous reports and year first reported to Plant Disease Survey: Massachusetts (1916), New York (1915), New Jersey (1915), Pennsylvania (1913), Delaware (1922), Ohio (1922), Indiana (1915), Michigan (1912).

Wilt caused by Fusarium sp.

Florida - local and said to be doing much damage. (Burger)

Phyllosticta antirrhini Syd.

Virginia - Warrenton (PHN5)

Recent literature

Guba, E. F. and P. J. Andrews. Phyllosticta leaf spot and damping off of snapdragon. Phytopath. 9: 315-325. 1919. Bot. Absts. 4. No. 1. July 1920.
Symptoms of the disease and cultural characteristics of Phyllosticta antirrhini in Antirrhinum majus are given. Wounding is not necessary for infection. High air and soil humidities favor a severe attack of the fungus. All types of the disease except the damping off may be controlled by the use of Bordeaux mixture (4:4:50). H. Johann.

Smiley Edwina M. The Phyllosticta blight of snapdragon. Phytopath. 10: 232-248. 8 fig. 1920. Bot. Absts. 8. no. 2. June, 1921. Antirrhinum majus is the only host known to be affected by Phyllosticta antirrhini. Symptoms, etiology, and pathological effects of the disease are discussed.- Ruth G. Bitterman.

Cladosporium sp.
Ohio - first report in state - appeared April 2 in a greenhouse in Sandusky County. (Detmers)

Stem rot cause unknown
New York - (Massey)

Mosaic cause undetermined
Ohio - first report for state, produced a mottling of leaves and blossoms of snapdragon in a greenhouse in Sandusky County. Appeared April 15. (Detmers)

Verticillium wilt caused by Verticillium albo-atrum McA.

Literature
Bewley, W. F. Sleepy disease or wilt of tomato. Nursery and Market Garden, Ind. Dev. Soc. Exp. & Research Sta. Ann. Rpt. 1920: 30. 1921. Snapdragon infected artificially

Verticillium wilt caused by Verticillium sp.

Literature
Brown, Nellie Adalesa. A snapdragon wilt due to Verticillium. Phytopath. 4. no. 3: 217. June, 1914.

SNOWBERRY - (Symphoricarpus orbiculatus)
Powdery mildew caused by Microsphaera diffusa Cke. & Pk.
Illinois - probably ranges throughout state, injury caused chiefly that of the disfiguring appearance of host. (Tehon)

SNOWBERRY (Symphoricarpus racemosus)
Powdery mildew caused by Microsphaera symphoricarpi Howe
Idaho - found occasionally; causes little injury. (Boyce)

SNOWBERRY (Symphoricarpus spp.)
Powdery mildew caused by Microsphaera diffusa Cke. & Pk.
Washington - (Dana)

Rust caused by Aecidium abundans Pk.
Idaho - (Dana)

SPIRAEA (Spiraea opulifolia var. aurea)
Powdery mildew caused by Sphaerotheca humuli (DC.) Burr.
Connecticut - a new host to state. (Clinton)

SWEET PEA (Lathyrus odoratus)
Powdery mildew caused by Microsphaera alni (DC.) Wint.
West Virginia - abundant where present in Morgantown. (Sheldon)
North Dakota - unimportant, May 24 at Grafton. (Weniger)

Black root rot caused by Thielavia basicola (B. & Br.) Zopf.
Connecticut - present in a greenhouse. (Clinton)
Ohio - first report for state - found in a greenhouse causing a dampingoff condition. (Detmers)

Root rot caused by Pythium debaryanum Hesse
Connecticut - local. (Clinton)

Root rot caused by Rhizoctonia sp.
Massachusetts - has rendered the growing of sweet peas a failure in many localities, it is so very serious; reported as questioned whether it is a Rhizoctonia or a Fusarium sp. (Osmun)
Washington - (Dana)

Mosaic - cause undetermined
Ohio - one report only; causes a mottling of leaves and blossoms; present in a greenhouse. (Detmers)

SYRINGA (Philadelphus sp.)
Shot hole, cause not determined
Ohio - (Detmers)

THIMBLE-BERRY (Rubus parviflorus)
Leaf spot caused by Septoria rubi West
Idaho -fairly common, but does little damage. (Boyce)

Macrophoma sp.
District of Columbia - (Collins)

VIOLET (Viola spp.)
Black root rot caused by Thielavia basicola (B. & Br.) Zopf.
New York - (Massey)

Leaf spot caused by Phyllosticta violae Desm.
South Carolina - unimportant (Ludwig)

Powdery mildew caused by Sphaerotheca humuli var. fuliginea (Schlecht) Salm.
Minnesota - observed only in Ramsey County. (Sect. Pl. Path.)

Soft rot caused by Bacillus carotovorus Jones

Literature

Lacey, Margaret S. Studies in bacteriosis. VI Bacillus carotovorus as the cause of soft rot in cultivated violets. Ann. Appl. Biol. 9: 169-170. June. 1922. no. 2

WASHINGTONIA FILIFERA
Phoma palmicola Wint.
Texas - (PHN5)

YUCCA (Yucca sp.)

Heottiospora yuccaefolia Hall

Georgia - Fort Valley. (Dunegan)

ZINNIA (Zinnia sp.)

Powdery mildew caused by Erysiphe cichoracearum DC.

West Virginia - found late in season on a few plants. (Sheldon)

Texas - frequently a common foliage disease of the zinnia during wet seasons or as the plant becomes old. Only the conidial or oidium stage was found. (Taubenhaus)

Illinois - ordinarily, zinnias are considered very hardy and subject to few diseases. During wet weather, however, the foliage is frequently killed by this fungus. (Taubenhaus)

DISEASES OF MISCELLANEOUS PLANTS

ASTER sp.

Rust caused by Coleosporium solidaginis (Schw.) Thüm

Colorado - Ft. Collins, Larimer Co., September (Learn)

BORAGE

Rio Grande Disease

Texas - a new host; a weed which is used by the Mexicans as a food for burros. (Taubenhaus)

BURSA BURSA-PASTORIS

White rust caused by Albugo candida (Pers.) Kuntze

Oklahoma - there was favorable warm moist weather for the disease. (Stratton)

California - general and widespread. (Fields)

Recent literature

Petrescu, C. Contribution à l'etude biologique de la flore de Moldavie, champignons parasites des cruciferes. Compt. Rend. Soc. Biol. Paris 87: 748-749. Ji. 1922. No. 27. Cystopus candidus and Peronospora parasitica on Capsella bursa-pastoria.

CACTUS

Charcoal spot caused by Perisporium wrightii B. Nc.

Texas - this fungus was readily isolated and although perithecia were formed, there was not a single instance of their maturing; the spores as found in the pe rithecia on the host were incapable of germinating and it is difficult to explain how this disease has spread and assumed such wide proportions. (Taubenhaus)

Damping-off, cause not fully determined.

Texas - frequently when cactus joints have been planted in wet soil, they dampoff within a week or ten days after being planted. (Taubenhaus)

CEANOTHUS VELUTINUS

Cylindrosporium ceanthi Ell. & Ev.

Oregon - common, elevation 1800 feet. (Boyce)

COFFEE (Coffea spp.)

Leaf spot caused by Cercospora coffeicola Berk. & Cke.

Recent literature

Welles, C. G. Cercospora leaf spot of coffee. Philipp. Jour. Sci. 19: 741-745. Dec. 1921.

Summary: -

"Leaf spot of coffee, caused by Cercospora coffeicola Berkeley & Cooke has been found on nursery stock of the College of Agriculture, Los Banos Laguna.

"This is known as 'brown eye spot', 'brown eyed disease' or 'berry spot.'

"In the Philippines attack is confined to leaves and therefore it is not very serious. It may spread to berries and become more dangerous. It is found only on Coffea bukobensis. The source of the disease is unknown. The causal organism checks with the previously described Cercospora coffeicola Berkeley & Cooke. The disease was controlled by spraying every two weeks with Bordeaux mixture."

COREOPSIS (Coreopsis spp.)

Rust caused by Coleosporium inconspicuum (Long) Hedgc. & Long

The following distribution summary is of interest, taken from article by Hedgcock, Geo. A. and N. Rex Hunt. Notes on some species of Coleosporium I. Mycologia 14: 244-257. Pl. 20-21. Sept. 1922.

Coreopsis delphinifolia: Tennessee
C. lanceolata: North Carolina, Tennessee
C. major: Georgia, North Carolina, South Carolina, Tennessee
C. major oemleri: Georgia, North Carolina, Tennessee, Virginia.
C. major rigida: Georgia, North Carolina, Tennessee
C. tripteris: Georgia, Tennessee
C. verticillata: D.C., Maryland, North Carolina, Virginia
Range from Maryland and Michigan south to Georgia and west to Tennessee.

CRYPTANTHA INTERMEDIA

Synchytrium myosotidis Kuehn.

California - Los Angeles, Apr. 22 (PHN5)

DATURA STRAMONIUM (Jimson weed)

Leaf blight caused by Alternaria crassa (Sacc.) Rands

Illinois - Goreville, Johnson County. (Tehon)

DATURA TATULA (Purple tatula)

Leaf blight caused by Alternaria crassa (Sacc.) Rands

Illinois - East Carondelet, St. Clair County. (Tehon)

DIODIA TERES (Button weed)

Rust caused by Puccinia lateritia Berk. & Curb. = (Puccinia spermacoces B. & C.)

Illinois - Creal Springs, Williamson County. (Tehon)

DOCK (Rumex occidentalis)

Leaf spot caused by Sphaerella rumicis (Desm.) Ell.

Oregon - not important. (Boyce)

DUCHESNEA INDICA

Perpnospora potentillae DeBy.

North Carolina - Winston, Salem, Apr. 24. Coll. B. O. Dodge (PHN5)

ERIGERON ANNUUS

Ophiobolus tenellus (Auersw.) Sacc.

Virginia - Fairfax County, June 27. Coll. Ricker & Diehl. (PHN5)

ERODIUM MOSCHATUM

Synchytrium papillatum Farl.

Recent literature

McMurphy. Notes on Synchytrium. (Abst.) Phytopath. 12:442. Sept. 1922.

EUPHORBIA spp.

Uromyces spp.

Recent literature

Mains, E. B. Evidence of the seed carriage of the Euphorbia rusts, Uromyces proeminens and Uromyces dictosperma. Proc. Indiana Acad. 1921: 137-139. 1922.

EUTHAMIA spp.

Rust caused by Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long

Distribution as collected in the United States and as reported by Hedgcock, G. G. & N. Rex Hunt. Notes on some species of Coleosporium. I. Mycologia 14: 244-257. Pl. 20-21. Sept. 1922.

Euthamia caroliniana - New Jersey & Florida.

Euthamia graminifolia - Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, Indiana, Illinois, Missouri, and Kansas.

Euthamia leptophylla - Louisiana and Texas

FERN, BRAKE (Pteridium aquilinum pubescens)
Fir fern rust caused by Uredinopsis mirabilis (Pk.) Magn.
British Columbia - does not injure the host. (Boyce)

FIREWEED (Epilobium augustifolium)
Fir fireweed rust caused by Pucciniastrum pustulatum (Pers.) Diet.
Idaho and British Columbia - results in premature reddening of infected leaves. (Boyce)

GAYLUSSACIA sp. (Huckleberry)
Rust caused by Pucciniastrum myrtilli (Schum.) Arth.
Pennsylvania - not very injurious; collected in July. (Overholts)

GOLDEN SEAL (Hydrastis canadensis)
Alternaria blight caused by Alternaria sp.
New York - reported in 1907 by Whetzel, found at Tomhannock, June 15, causing a 5-10% loss. Control suggested is spraying with Bordeaux mixture.

Recent literature
Stevens, F. L. and J. G. Hall. Golden seal blight. In Diseases of Economic Plants, 1917: 240. The McMillan Co., 1917.
"Blight (Alternaria sp.) spots occur upon the leaves. The disease seems to be identical with that of ginseng."

Blight caused by Botrytis sp.
New York, 1918.
Connecticut - found in 1919 in cultivated beds. (Clinton)
" - found in 1920 at Mt. Carmel. New to state, causing more or less injury, found also on ginseng. (Clinton)
Maryland - (Fowler)
Indiana - reported September 7, 1921. (Gardner)
Washington - reported in 1921. (Dana)

Recent literature
Whetzel, Herbert Hice. The Botrytis blight of golden seal. (Abstract) Phytopath. 8: 75-76. F. 1918.

Fusarium wilt caused by Fusarium sp.
Ohio - new disease in state. Reported August 7, 1914 from Monroe County. Soil sterilization reported as control measure. (Selby)
Illinois - noted for the first time in state in 1911. Caused a 50-75% injury locally in Schuyler County.

Root knot caused by Heterodera radicicola (Greef.) Mull
Ohio - first known occurrence in the state August 7, 1914. Soil steaming suggested as treatment.

Recent literature
McClintock, J. A. Is golden seal resistant to root knot nematode? Phytopath. 4: 33. no. 1. Feb. 1914.

Mosaic - cause unknown

Connecticut - reported in 1920 as a new disease for the state; as yet not prevalent; found June 7 at Mt. Carmel.

Leaf scorch

Michigan - in 1913 about 2% injury occurred ranging through the central western and southern counties. (Coons)

Unknown root rot was reported in 1913 by G. H. Coons from Michigan. It caused a rotting of the root fibers and of the main root up to the crown.

HELIANTHUS spp.

Rust caused by Coleosporium helianthi (Schw.) Arth.

Distribution in the United States as reported by Hedgcock, G. G. and N. Rex Hunt. Notes on some species of Coleosporium - I. Mycologia 14: 244-257. Pl. 20-21. Sept. 1922.

Helianthus australis: North Carolina
H. decapetalus: New York, Pennsylvania, Maryland, Virginia, North Carolina, South Carolina, Tennessee and Indiana.
H. divaricatus: Pennsylvania, District of Columbia, Virginia, North Carolina, Georgia and Tennessee.
H. doroconoides: Ohio and Minnesota
H. eggertii: Tennessee
H. giganteus: New York, Pennsylvania, West Virginia, Alabama and Mississippi.
H. glaucus: Tennessee and Georgia
H. grosseserratus: West Virginia and North Carolina
H. microcephalus: Virginia, North Carolina, South Carolina, Georgia, Alabama and Tennessee
H. occidentalis: Louisiana
H. saxicola: Georgia
H. strumosus: Alabama
H. tuberosus: Virginia, South Carolina and Alabama

Rust caused by Puccinia helianthi Schw.

Literature

Maneval, W. E. Germination of teliospores of rust at Columbia, Mo. Phytopath. 17: 471-488. Oct., 1922. Literature cited: p. 487-488.

HEUCHERA GLABRA

Puccinia heucherae (S.) Diet.

Alaska - Juneau, Aug. 6. Coll. N. E. Stevens. (PHN5)

HIPPEASTRUM JOHNSONII

Mosaic caused by intracellular bodies. McKinney, H. H., Sophie H. Eckerson, and R. W. Webb. Phytopath. (Abst.) 13: 41. Jan. 1923. no. 1. (Cooperative investigations by Wis. Agr. Exp. Sta. and Cereal Investigations, B. P. I., U. S. Dept. Agr.)

HUMULUS LUPULUS L. (Hop)

Downy mildew caused by Pseudoperonospora humuli (Miyabe & Takah.) Wilson = (Plasmopora humuli Miyabe & Takah.)

Wisconsin - Dr. Davis collected the fungus in 1922 at Edgerton, Rock County and believes it to be indigenous. (Vaughan)

Canker caused by Fusarium parasiticum Tub.

Literature

Salmon, E. S. and H. Wormald. Hop "Canker" or growing off." Jour. Min. Agr. Gt. Brit. 29: 354-359. 1922.

HUMULUS sp. (Hop)

Mosaic, cause not given

Literature

Salmon, E. S. The "Mosaic" disease of the hop. Jour. Min. Agr. Gt. Brit. 29: 927-934. pl. Ja. 1923.
Summary of article as follows:
Two diseases of hop in England apparently belonging to virus group - "nettlehead" and mosaic. The former is less important. Article deals with mosaic.
Disease spread by means of cuttings taken from affected plants at a time when these are still apparently healthy.

Mildew caused by Sphaerotheca humuli (DC.) Burr.

Literature

Horton, E. and E. S. Salmon. The fungicidal properties of certain spray fluids III. Journ. Agr. Sci. 12: 269-279. July. 1922. Bibliography: 279. The article gives the results of tests with several compounds on conidial stage of S. humuli on young hop leaves in the greenhouse.

INDIAN PAINT BRUSH (Castilleja angustifolium)

Western pine gall rust caused by Cronartium harknessii (Moore) Meinecke

Oregon - (Boyce)

KINNIKINNICK (Arctostaphylos uva - ursa)

Exobasidium vaccinii (Fckl.) Wor.

Oregon - aggregate damage to the host is slight. The causal organism causes the young shoots and leaves to be slightly deformed. (Boyce)

LABRADOR TEA (Ledum groenlaudicum)

Leaf rust caused by Melampsoropsis ledicola (Pk.) Arth.

British Columbia - abundant but causes little injury. (Boyce)

Leaf rust caused by Melampsoropsis abietina (A. & S.) Arth.

British Columbia - rare; of little injury to host. (Boyce)

LIATRIS GRAMINIFOLIA (Blazing Star)
Clasterosporium laciniariae Arth.
New Jersey - Atlantic City, Aug. 20. Coll. E. K. Cash. (PHN5)

LIPPIA LANCEOLATA
Cercospora lippiae Ell. & Ev.
Virginia - Black Pond, July 12. Coll., A. E. Jenkins (PHN5)

LOTUS spp.
Synchytrium sp.

Literature
McMurphy, James. Notes on Synchytrium (Abst.) Phytopath. 12: 442. Sept. 1922.

LUDWIGIA ALTERNIFOLIUS
Septoria ludwigiae Cke.
Maryland - North Beach, Aug. 19. Coll. J. A. Stevenson and W. W. Diehl. (PHN5)

LUPINUS PERENNIS
Powdery mildew caused by Erysiphe polygoni DC.
Maryland - Riverside, July 1, Coll. A. E. Jenkins. (PHN 5)

LYCOPODIUM COMPLANATUM var. FLABELLIFORME
Didymella chamaecyparissi Rehm
Virginia - Fairfax County, Apr. 2. Coll. W. W. Diehl. (PHN5)

MANZANITA (Arctostaphylos manzanita)
Exobasidium vaccinii (Fckl.) Wor.
Oregon - the young shoots and leaves are slightly deformed by this fungus giving the appearance of small witches brooms. (Boyce)

Leaf rust caused by Pucciniastrum sparsum (Wint.) Ed. Fisch.
Oregon - causes little injury. (Boyce)

MONARDA FISTULOSA
Rust caused by Puccinia menthae Pers. var. americana Burr.

Literature
Maneval, W. E. Germination of teliospores of rusts at Columbia, Missouri. Phytopath. 12: 471-488. Oct. 1922. Literature cited. p. 487-488.

NYMPHAEA ODORATA
Sphaerella pontederiae Pk.
Virginia - Black Pond, Fairfax County, July 12. Coll. W. W. Diehl. (PHN5)

OENOTHERA sp.

Mildew caused by Erysiphe polygoni DC.

Literature

Klaphaak, P. J. & H. H. Bartlett. A preliminary notice of genetical studies of resistance to mildew in Oenothera. Amer. Journ. Bot. 9: 446-458. Oct. 1922. No. 8. Literature cited p. 457-458.

PARTHENIUM INTEGRIFOLIUM

Rust caused by Coleosporium terebinthinaceae (Schw.) Arth.

According to Hedgcock, Geo. G. & N. Rex Hunt. Notes on some species of Coleosporium -I. Mycologia 14: 244-257. Pl. 20-21. Sept. 1922. This rust has been collected in Virginia, Tennessee, North Carolina, Georgia and Alabama.

PHYLLOSTACHYS sp.

Rust caused by Puccinia melanocephala Sydow

Florida - a specimen of this rust was sent in by O. F. Burger, May 25. It was collected at Jacksonville by the nursery inspector. Later, upon investigations, several places were revealed where the bamboo was affected by this rust. The Office of Foreign Plant Quarantines has several specimens of this disease from Brookville and also a collection from an estate near Gotha. The present known geographical distribution of the disease in the United States is Brookville, Jacksonville and Gotha, Florida. It also occurs in Asia. See North American Flora 75: 340.

PLANTAGO sp.

Leaf spot caused by Septoria sp.

Ohio - Wayne County. (Detmers)

PODOPHYLLUM PELTATUM

Phyllosticta podophylli Wint.

Illinois - Peters, May 25. Coll. J. F. Dickman. (PHN5)

POTENTILLA CANADENSIS

Rust caused by Phragmidium potentillae-canadensis Diet.

Literature

Maneval, W. E. Germination of teliospores of rusts at Columbia, Missouri. Phytopath. 12: 471-488. Oct. 1922. Literature cited p. 487-488.

PSORALEA LANCEOLATA

Rust, cause undetermined.

Montana - on June 23 a rust was observed in Forsyth, Rosebud County, causing a 2% infection. (Christopher)

RHUS DIVERSILOBA

Septoria irregularis Pk. = (Phleospora irregulare (Pk.) Bul.)
Oregon - common; elevation 900 feet. (Boyce)

RHUS sp.

Septoria irregularis Pk.
California - (Boyce)

RIBES spp.

Rust caused by Cronartium ribicola Fischer
Connecticut - heavily infected. (Clinton)
New York - found along the extreme eastern border of the state. (Dickson)
Pennsylvania - found in four localities in Wayne County and one in Lackawanna. (McCubbin)

Rust caused by Puccinia ribis DC.
North Dakota - very abundant during 1922. (Weniger)

Nectria vulgaris Tode = (Tubercularia vulgaris Tode)
Oregon - elevation 200 feet. (Boyce)

RUBUS PARVIFLORUS

Rust caused by Phragmidium sp.
British Columbia - Salmon Arm (Dana) This report is included due to the occurrence of the rust near Washington State boundary.

RUELLA STREPENS

Rust caused by Puccinia ruellia (B. & Br.) Lagh.

Literature

Maneval, W. E. Germination of teliospores of rusts at Columbia, Missouri. Phytopath. 12: 471-488. Oct. 1922. Literature cited p. 487-488.

SCIRPUS OCCIDENTALIS

Clasterosporium caricinum S.
Minnesota - Lake Chetek, Currie. July 24. T. P. Metcalf. (PHN5)

SEDUM PURPUREUM

Stem rot supposedly caused by a Phytophthora sp.
New York - the host grew on the College Farm until entirely killed out. The farmers write in for affected plants to transplant on their farms as they have been using the diseased plants for means of eradication on account of the organism spreading until its host is entirely eradicated. Many plants were sent out by the College during the past ten years for this purpose. (Chupp)

SILPHIUM spp.

Rust caused by Coleosporium terebinthinaceae (Schw.) Arth.

Collected in the United States and reported by Hedgcock, G. G. and N. Rex Hunt, in Notes on some Species of Coleosporium - I. Mycologia 14: 244-257. Pl. 20-21. Sept. 1921.

Silphium angustatum - South Carolina, Georgia and Alabama.
S. asperrimum - Texas.
S. asteriscus - North Carolina, South Carolina, Georgia and Louisiana.
S. compositum - Virginia, Tennessee, North Carolina, Georgia and Alabama.
S. dentatum - North Carolina, South Carolina and Georgia.
S. glabrum - Tennessee and Georgia.
S. gracile - Texas.
S. integrifolium - Georgia, Alabama, Mississippi, Louisiana, Arkansas, Indiana, Illinois and Missouri.
S. laciniatum - Iowa and Kansas.
S. laevigatum - Alabama.
S. pinnatifidum - Georgia.
S. terebinthinaceum - North Carolina, Indiana and Illinois.
S. trifoliatum - Virginia, North Carolina and Alabama.

SPIRAEA DOUGLASII Hook.

Cylindrosporium spiraeicolum Ell. & Ev.

Oregon - abundant; elevation 4100 feet. (Boyce)

TARAXACUM spp.

Rust caused by Puccinii taraxaci (Rabent.) Plowr.

Distribution in the United States as reported to the Plant Disease Survey - New Jersey, Pennsylvania, Maryland, West Virginia, Indiana, Minnesota, Missouri, Nebraska, Colorado, Utah, Indiana and Washington.

Powdery mildew caused by Sphaerotheca humuli (DC) Burr. var. fuliginea (Schlecht.) Salm.

Distribution in the United States as reported to the Plant Disease Survey: Connecticut, Ohio, Minnesota and Idaho.

The following extract from Salmon's monograph of the Erysiphaceae, p. 60, may be of value to those who are interested in hop culture:

"Whitehead (C. Whitehead. Hop Cultivation L. C. 4: 246-249, 1893) recommends as a preventive method against the hop mildew the removal of all other plants which are the hosts of the fungus from the hop gardens, and mentions especially Taraxacum, Senecio vulgaris and other composites and Plantago. These host plants of the old aggregate species 'S. castagnei' all belong, however, to the form now separated as S. humuli var. fuliginea, while the hop mildew is caused by the type of S. humuli."

Leaf spot caused by Ramularia taraxaci Karst.
Reported former years from Minnesota and Idaho.

THALICTRUM DIOCIUM (Early meadow-rue)
Rust caused by Puccinia agropyri Ell. & Ev. = (P. clematidis Lagh.)
Minnesota - Hennepin County. (Sect. Pl. Path.)

VACCINIUM CORYBOSUM (Huckleberry)
Tar spot caused by Rhytisma vaccini Fr.
Pennsylvania - very common in Bear Meadows. (Overholts)

VACCINIUM spp. (Huckleberry)
Leaf rust caused by Pucciniastrum myrtilli. (Schum.) Arth.
Connecticut - more prevalent. (Clinton)
Idaho - causes little damage; is found only occasionally. (Boyce)

VACCINIUM sp. (Blueberry)
Rust caused by Pucciniastrum myrtilli (Schum.) Arth.
Connecticut - (Clinton)

Rust caused by Calyptospora goeppertiana Jul. Kuehn.
Connecticut - (Clinton)

VERBESINA spp.
Rust caused by Coleosporium sp.

Recent literature
Hedgcock, Geo. G. & N. Rex Hunt. Notes on some species of Coleosporium - I. Mycologia 14: 244-257. Pl. 20-21. Sept. 1922.

VICIA AMERICANA
Powdery mildew caused by Erysiphe polygoni DC. = (E. communis)
Montana - (Childs, V. K.)

VITIS QUADRANGULARIS
Schizonella colemani Syngar & Narasimhan

Recent literature
Parthasarathy Lyengar, M. O. and Narasimhan, M. J. Phytopath. 12: 435-438. illus. Sept. 1922. no. 9.

CROP LOSSES FROM PLANT DISEASES IN THE UNITED STATES

IN 1922

Plant Disease Bulletin
Supplement 30

~~April 19, 1924.~~

CONTENTS

Wheat 463
Rye 465
Barley 467
Oats 469
Corn 471
Potato 473
Sweet potato 477
Tomato 478
Dry bean ... 479
Cotton 481
Apple 482
Peach 484
Pear 486
Plum & Prune 488
Cherry 489
Grape 490
Raspberry ... 490

INTRODUCTORY STATEMENT

The accompanying tabulations showing crop losses from diseases in 1923 have been prepared from estimates furnished by the collaborators of the Plant Disease Survey. They constitute the sixth annual set of loss estimates thus prepared.

The methods of making these estimates are the same as those followed in other years and already have been explained (Plant Disease Bulletin Supplements 6, 12, and 24). However, an additional explanation might be made regarding the way collaborators make their estimates. They estimate first the percentage of infested fields or plantings in the state. Then they make an estimate of the percentage of affected plants in the infested fields. From these two figures a third is obtained, representing the percentage of infected plants in the state. An estimate is then finally made of the percentage reduction in yield for the state that this percentage of diseased plants would cause. The results are tabulated at Washington and resubmitted to collaborators for approval before they are finally issued.

Estimated percentage loss to eleven crops from plant diseases 1919 to 1922

Crop	Per cent loss				Crop	Per cent loss			
	1919	1920	1921	1922		1919	1920	1921	1922
Wheat	16.96	11.70	9.2	8.9	Sweet potato	36.23	25.8	28.3	21.49
Rye	1.74	1.98	1.4	1.9	Dry bean	3.70	4.3	14.1	16.1
Barley	5.90	4.60	5.7	4.6	Cotton	13.59	13.4	15.8	9.2
Oats	5.90	4.80	8.6	5.6	Apple	11.37	16.5	11.3	22.5
Corn	6.41	6.39	8.8	6.0	Peach	12.04	19.4	15.3	18.6
Potato	19.50	21.70	18.6	21.1					

Estimated reduction in yield of wheat due to scab (*Fusarium* sp.), leaf rust (*Puccinia triticina*), stem rust (*Puccinia graminis*), bunt (*Tilletia laevis* and *T. tritici*), loose smut (*Ustilago tritici*), and other diseases, 1922.

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases: Scab %	Scab Bushels (000 omitted)	Leaf rust %	Leaf rust Bushels (000 omitted)	Stem rust %	Stem rust Bushels (000 omitted)	Bunt %	Bunt Bushels (000 omitted)	Loose smut %	Loose smut Bushels (000 omitted)	Other diseases %	Other diseases Bushels (000 omitted)	All diseases %	All diseases Bushels (000 omitted)
Me.	275	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vt.	189	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mass.	-	-	-	t	+	t	+	t	+	2	+	-	-	2 +	-
Conn.	-	-	-	t	+	t	+	-	-	0.5	+	-	-	0.5+	+
N. Y.	9,014	1.5	149	3	299	t	+	t	+	1	100	4	398	9.5+	946
N. J.	1,540	1	15	-	-	-	-	-	-	-	-	-	-	1 +	15
Pa.	25,444	5	1,462	4	1,170	t	+	t	+	3	877	1	293	13 +	3,802
Del.	1,766	1	19	2	37	t	+	t	+	0.5	9	2	37	5.5+	102+
Md.	9,537	3	331	5	551	0.5	55	1.5	165	3	331	0.5	55	13.5+	1,488+
Va.	10,375	0.5	58	5	581	t	+	1	116	2.7	314	1.5	174	10.7+	1,243+
W.Va.	2,760	3	110	18	663	t	+	t	+	3	110	1	37	25 +	920
N. C.	5,508	-	-	-	-	0	0	-	-	-	-	-	-	-	+
S. C.	1,320	-	-	10	148	0	0	-	-	1	15	-	-	11 +	163
Ga.	1,520	-	-	5	84	-	-	1	17	2	33	1	17	9 +	151
Ohio	35,644	5	2,510	5	2,510	2	1,004	t	+	2	1,004	15	7,531	2	14,559
Ind.	29,798	t	+	10	3,453	0.7	242	t	+	3	1,036	t	+	13.7+	4,731+
Ill.	55,432	2	1,360	10	6,802	0.5	340	2	1,360	3	2,040	1	680	13.5	12,582
Mich.	14,326	-	-	2	298	2	298	t	+	-	-	-	-	4 +	596+
Wis.	3,006	t	+	1	32	5.1	164	t	+	0.5	16	t	+	5.6+	212+
Minn.	27,036	t	+	0.5	148	5	1,477	t	+	0.5	148	2.5	739	8.5+	2,512+
Iowa	16,867	0	0	t	+	1	174	t	+	2	348	0	0	3 +	522+
Mo.	38,818	t	+	-	-	0	0	-	-	1	392	-	-	1 +	392+
N. D.	123,234	t	+	1	1,433	10	14,330	t	+	1	1,433	2	2,866	14 +	20,062
S. D.	40,012	t	+	t	+	3	1,237	t	+	t	+	-	-	3 +	1,237

State	Production 1921 Bushels (000 omitted)	Estimated reduction in yield due to diseases: Scab %	Scab Bushels (000 omitted)	Leaf rust %	Leaf rust Bushels (000 omitted)	Stem rust %	Stem rust Bushels (000 omitted)	Bunt %	Bunt Bushels (000 omitted)	Loose smut %	Loose smut Bushels (000 omitted)	Other diseases %	Other diseases Bushels (000 omitted)	All diseases %	All diseases Bushels (000 omitted)
Nebr.	59,838	t	+	-	-	0.5	301	-	-	-	-	-	-	0.5+	301
Kans.	122,887	t	+	1	1,264	0.3	379	t	+	0.5	632	1	1,264	8 +	3,539
Ky.	7,475	1	90	10	901	0	0	-	-	4	360	2	180	17	1,531+
Tenn.	4,484	1	54	15	810	t	+	1	54	t	+	-	-	17 +	918
Ala.	218	t	+	3	7	t	+	0	0	1	2	-	-	4 +	9
Miss.	60	0	0	2	1	t	+	0	0	t	+	-	-	2 +	1
Tex.	9,992	0	0	1	119	10	1,190	-	-	5	595	-	-	16	1,904
Okla.	31,350	0	0	5	1,675	-	-	-	-	0.5	167	0.9	301	6.4	2,143
Ark.	1,118	0	0	5	62	0	0	2	25	3	37	-	-	10	124
Mont.	40,370	0	0	t	+	0	0	-	-	t	+	-	-	+	+
Wyo.	3,060	0	0	t	+	0	0	-	-	-	-	-	-	+	+
Colo.	21,776	0	0	t	+	t	+	t	+	t	+	0	0	+	+
N. M.	865	0	0	-	-	-	-	-	-	-	-	-	-	-	-
Ariz.	1,274	0	0	-	-	1	13	-	-	t	+	-	-	1 +	13+
Utah	5,682	0	0	t	59	1	70	-	-	1	59	t	+	2 +	188
Nev.	550	0	0	0	0	-	-	-	-	-	-	-	-	-	-
Idaho	24,275	0	0	0	0	t	+	8	2,271	1.5	426	5	1,420	14.5+	4,117
Wash.	32,444	0	0	0	0	0	0	5	1,708	t	+	t	+	5 +	1,708
Oreg.	19,744	0	0	t	+	0	0	-	-	t	+	-	-	t	-
Cal.	15,308	0	0	t	+	t	+	0.5	82	t	+	6	982	6.5+	1,064+
U. S.	856,211	.6	6,158	2.5	23,107	2.3	21,274	.6	5,798	1.1	10,484	1.8	16,974	8.9	83,795

RYE

Estimated reduction in yield of rye due to smut (Ustilago sp.), ergot (Claviceps purpurea), leaf rust (Puccinia dispersa), stem rust (Puccinia graminis), and other diseases, 1922.

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases: Smut %	Smut Bushels (000 omitted)	Ergot %	Ergot Bushels (000 omitted)	Leaf rust %	Leaf rust Bushels (000 omitted)	Stem rust %	Stem rust Bushels (000 omitted)	Other diseases %	Other diseases Bushels (000 omitted)	All diseases %	All diseases Bushels (000 omitted)
Mass.	57	t	+	t	+	t	+	t	+	-	-	t+	+
Conn.	100	-	-	-	-	1	1	-	-	1	1	2	2
N. Y.	880	-	-	-	-	1	9	t	+	1	9	2+	18+
N. J.	1,159	-	-	-	-	-	-	-	-	-	-	-	-
Pa.	3,740	t	+	t	+	t	+	-	-	-	-	t+	-
Del.	70	-	-	-	-	0.5	+	t	+	0.5	+	1+	+
Md.	258	t	+	0	0	1.5	4	t	+	t	+	1.5+	4+
Va.	460	-	-	t	+	1	5	t	+	2	9	3+	14
W. Va.	120	-	-	t	+	t	+	t	+	t	+	t+	+
N. C.	320	-	-	-	-	-	-	0	0	0	-	-	-
S. C.	60	-	-	-	-	1	1	-	-	1	1	2	2
Ga.	171	-	-	-	-	1	2	t	+	-	-	1+	2+
Ohio	1,235	-	-	0.5	6	2	26	1	13	-	-	3.5	45
Ind.	3,816	t	+	t	+	2	81	t	+	4	162	6+	243+
Ill.	4,096	-	-	0.5	21	2	85	0.5	21	1	43	4	170
Mich.	8,294	-	-	t	+	-	-	t	+	-	-	t	+
Wis.	7,139	t	+	0.5	36	t	+	t	+	t	+	0.5+	36+
Minn.	21,926	1	226	0.5	113	t	+	0.5	113	1	226	3+	678+
Iowa	1,140	-	-	0	0	t	+	t	+	-	-	t+	+
Mo.	336	-	-	-	-	-	-	0	0	-	-	-	-
N. D.	24,506	t	+	0.5	126	t	+	t	+	2	503	2.5+	629+
S. D.	7,902	-	-	t	+	-	-	t	+	-	-	t+	+

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases: Smut %	Smut Bushels (000 omitted)	Ergot %	Ergot Bushels (000 omitted)	Leaf rust %	Leaf rust Bushels (000 omitted)	Stem rust %	Stem rust Bushels (000 omitted)	Other diseases %	Other diseases Bushels (000 omitted)	All diseases %	All diseases Bushels (000 omitted)
Nebr.	2,106	-	-	-	-	-	-	t	+	-	-	t	+
Kans.	852	-	-	-	-	-	-	t	+	1	9	1 +	9+
Ky.	230	0	0	t	+	t	+	0	0	-	-	t +	+
Tenn.	180	0	0	0	0	t	+	t	+	t	+	t +	+
Ala.	5	-	-	-	-	0.5	+	t	+	-	-	0.5 +	+
Miss.	---	-	-	-	-	t	+	t	+	-	-	t +	+
Tex.	117	-	-	-	-	-	-	-	-	-	-	-	-
Okla.	310	-	-	-	-	t	+	0	0	0.5	2	0.5 +	2+
Ark.	12	-	-	-	-	-	-	t	+	-	-	t	+
Mont.	1,827	-	-	-	-	* -	-	-	-	-	-	-	-
Wyo.	294	-	-	-	-	-	-	-	-	-	-	-	-
Colo.	873	0	0	0	0	*	-	t	+	0	0	t +	+
N. M.	8	-	-	-	-	-	-	0	0	-	-	-	-
Utah	120	-	-	* -	-	0	0	t	+	-	-	t +	+
Idaho	168	0	0	0	0	0	0	0	0	-	-	-	-
Wash.	169	0	0	0	0	0	0	0	0	-	-	-	-
Oreg.	444	-	-	-	-	0	0	0	0	-	-	-	-
Calif.	---	0	0	0	0	t	+	0	0	-	-	t	+
U. S.	95,497	0.2+	226	0.3	302	0.2	214	0.2-	147	1.	965	1.9	1,854+

BARLEY

Estimated reduction in yield of barley due to stripe (*Helminthosporium gramineum*), loose smut (*Ustilago nuda*), covered smut (*Ustilago hordei*), leaf rust (*Puccinia simplex*), stem rust (*Puccinia graminis*), and other diseases, 1922.

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases																	
		Stripe		Loose smut		Covered smut		Leaf rust		Stem rust		Other diseases		All diseases					
		%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)				
Me.	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
N. H.	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Vt.	290	t	+	T	+	2	6	-	-	t	+	-	-	2	+	6+			
Mass.	---	-	-	t	+	-	-	-	-	-	-	-	-	t		+			
Conn.	---	0	0	*	-	.05	-	t	+	-	-	-	-	.05	+	+			
N. Y.	4,108	t	+	2	86	t	+	t	+	t	+	3	130	5	+	216+			
N. J.	306	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Del.	---	t	+	-	-	-	-	-	-	t	+	5	+	5	+	--			
Md.	128	t	+	1	1	t	+	t	+	t	+	t	+	1	+	1+			
Va.	248	t	+	5	13	1	3	1	3	t	+	-	-	7	+	19+			
S. C.	---	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Ga.	---	-	-	-	-	3	+	1	+	0	0	-	-	4		-			
Ohio	1,424	-	-	-	-	-	-	-	-	0.5	7	2	29	2.5		36			
Ind.	714	2	15	2	15	t	+	t	+	t	+	-	-	4	+	30+			
Ill.	5,605	-	-	0.5	28	-	-	-	-	0.5	28	-	-	1		56			
Mich.	3,500	-	-	-	-	-	-	-	-	t	+	-	-	t		+			
Wis.	14,220	0.5	74	0.5	74	0.5	74	t	+	2	294	t	+	2.5	+	316+			
Minn.	24,062	2	517	0.5	129	1	259	-	-	1	259	2.5	647	7		1,811			
Iowa	4,260	5	251	2	100	2	100	t	+	6	301	-	-	15	+	752+			
Mo.	115	-	-	-	-	-	-	-	-	t	+	-	-	t		+			
N. D.	25,704	1	279	1	279	1	279	t	+	5	1,397	t	+	8	+	2,234+			
S. D.	21,896	-	-	t	+	t	+	-	-	2	451	1	226	3	+	677+			

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases																			
		Stripe		Loose smut		Covered smut		Leaf rust		Stem rust		Other diseases		All diseases							
		%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)						
Nebr.	4,356	-	-	-	-	-	-	-	-	1	44	-	-	1	44						
Kans.	19,332	-	-	3	624	3	624	-	-	t	+	1	208	7	+	1,456+					
Ky.	163	-	-	3	5	3	5	t	+	0	0	-	-	6	+	1+					
Tenn.	315	3	10	t	+	t	+	*0	0	0	0	t	+	3	+	10+					
Ala.	---	-	-	-	-	0.5	+	0	0	-	-	-	-	0.5		-					
Miss.	---	-	-	-	-	-	-	0	0	t	+	-	-	t		-					
Tex.	1,767	-	-	3	56	3	56	-	-	-	-	-	-	6		112					
Okla.	2,193	t	+	4	71	3	95	t	+	-	-	0.5	12	7.5		178+					
Mont.	1,925	-	-	-	-	-	-	-	-	0	0	-	-	-		-					
Wyo.	310	-	-	-	-	-	-	-	-	C	0	-	-	-		-					
Colo.	3,534	t	+	t	+	t	+	*-	-	t	+	t	+	t	+	-					
N. M.	140	-	-	-	-	-	-	-	-	-	-	-	-	-		-					
Ariz.	825	-	-	-	-	-	-	-	-	t	+	-	-	t		-					
Utah	630	4	26	t	+	t	+	*-	-	t	+	-	-	4	+	26+					
Nev.	176	-	-	-	-	-	-	-	-	-	-	-	-	-		-					
Idaho	2,890	t	+	-	-	0.5	15	0	0	0	0	-	-	0.5	+	15+					
Wash.	1,813	0	0	0	0	t	+	0	0	0	0	-	-		+	-					
Oreg.	2,160	t	+	0	0	0.5	11	0	0	C	0	.5	11	1	+	22+					
Calif.	36,864	t	+	t	+	1	376	t	+	t	+	1	376	2	+	752+					
U. S.	186,118	0.6	1,172	0.8	1,481	1	1,903	t	3	1.4	2,781	.8	1,639	4.6		8,979					

OATS

Estimated reduction in yield of oats due to loose and covered smuts (Ustilago avenae and U. Levis), stem rust (Puccinia graminis), crown rust (Puccinia coronata), and other diseases, 1922.

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases: Loose and covered smuts %	Loose and covered smuts Bushels (000 omitted)	Stem rust %	Stem rust Bushels (000 omitted)	Crown rust %	Crown rust Bushels (000 omitted)	Other diseases %	Other diseases Bushels (000 omitted)	All diseases %	All diseases Bushels (000 omitted)
Me.	4,940	-	-	-	-	-	-	-	-	-	-
N. H.	684	1	7	-	-	-	-	-	-	1	7
Vt.	3,132	4	133	-	-	2	67	-	-	6	200
Mass.	340	1	3	t	+	t	+	-	-	1 +	3+
R. I.	31	1	+	-	-	-	-	-	-	1	+
Conn.	308	2	6	-	-	1	3	-	-	3 +	9+
N. Y.	31,770	4	1,374	t	+	2.5	859	1	343	7.5+	2,576+
N. J.	2,232	2	46	-	-	-	-	-	-	2	46
Pa.	41,242	3	1,289	t	+	t	+	1	430	4 +	1,719+
Del.	161	1	2	t	+	t	+	1	2	2 +	4+
Md.	1,740	4	73	t	+	t	+	t	+	4 +	73+
Va.	3,320	5	177	t	+	1	35	-	-	6 +	212+
W. Va.	4,600	4	192	t	+	t	+	t	+	4 +	192+
N. C.	3,738	-	-	0	0	-	-	-	-	-	-
S. C.	9,744	2.5	263	-	-	-	-	5	527	7.5	790
Ca.	8,532	2.5	226	t	+	3	271	-	-	5.5+	497+
Fla.	481	-	-	-	-	-	-	-	-	-	-
Ohio	39,744	t	+0.5		202	1	403	-	-	1.5	605+
Ind.	28,770	3	908	t	+	2	606	-	-	5 +	1,514+
Ill.	110,010	5	6,112	t	+	4	4,889	1	1,222	10 +	12,223+
Mich.	19,434	2	1,030	2	1,030	-	-	-	-	4	2,060
Wis.	101,558	1	1,047	1	1,047	1	1,047	t	+	3 +	3,141+
Minn.	142,746	2	3,021	2	3,021	t	+	1.5	2,266	5.5+	8,308+
Iowa	222,851	2	4,691	1	2,346	1	2,346	1	2,346	5	11,729
Mo.	17,872	3	553	t	+	-	-	-	-	3 +	553+

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases: Loose and covered smuts %	Loose and covered smuts :000 omitted	Stem rust %	Stem rust Bushels	Crown rust %	Crown rust :000 omitted	Other diseases %	Other diseases :000 omitted	All diseases %	All diseases :000 omitted
N. D.	78,804	2	1,742	5	4,354	0.5	435+	2	1,742	9.5	8,273
S. D.	74,400	2	1,534	1	767	t	+	-	-	3+	2,301+
Nebr.	56,106	-	-	t	+	t	+	-	-	+	+
Kans.	28,386	3	925	t	+	t	+	5	1,543	8+	2,468+
Ky.	4,282	-	-	0	0	t	+	10	476	10+	476+
Tenn.	4,351	3	135	0	0	t	177	-	-	3+	135+
Ala.	5,540	3	177	t	+	3	306	-	-	6+	354+
Miss.	2,660	3	92	0	0	10	144	-	-	13	398
La.	1,249	t	+	0	0	10	6,275+	3	43	13+	187+
Tex.	33,465	5	2,091	-	-	15	+	-	-	20	8,366
Okla.	20,000	3.5	457	-	-	t	+	t	+	1.5+	457
Ark.	6,336	6	453	t	+	8	603	2	151	16+	1,207+
Mont.	19,200	-	-	0	0	-	-	-	-	-	-
Wyo.	5,056	-	-	0	0	-	-	-	-	-	-
Colo.	4,625	t	+	t	+	-	-	0	0	t	+
N. M.	930	-	-	-	-	-	-	-	-	-	-
Ariz.	620	4	26	t	+	-	-	-	-	4+	26+
Utah	3,354	5	177	t	+	-	-	-	-	5	177+
Nev.	112	-	-	-	-	-	-	-	-	-	-
Idaho	6,156	5	342	t	+	0	0	5	342	10+	684+
Wash.	9,959	0.5	40	0	0	0	0	-	-	0.5	40
Oreg.	6,675	0.5	34	t	+	t	+	.5	34	1+	68+
Calif.	5,250	1	+	1	55	t	+	3	164	4+	219+
U. S.	1,215,496	2.3	29,378	1	12,682	1.4	16,496	.9	11,631	5.6	72,297

Estimated reduction in yield of corn due to smut (Ustilago zeae), leaf rust (Puccinia sorghi), brown spot (Physoderma zeae-maydis), root and ear rots (Fusarium spp.) and other diseases, 1922.

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases					
		Smut		Leaf rust		Brown spot	
		%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)
Me.	1,312	t	+	-	-	0	0
N. H.	1,032	t	+	-	-	0	0
Vt.	3,444	2	70	-	-	0	0
Mass.	2,600	t	+	t	+	0	0
R. I.	560	-	-	-	-	0	0
Conn.	3,465	1.5	55	-	-	0	0
N. Y.	28,329	3	934	t	+	0	0
N. J.	9,912	1.5	157	-	-	-	-
Pa.	69,212	3	2,359	t	+	0	0
Del.	5,439	0.5	30	t	+	-	-
Md.	25,400	2	587	t	+	t	+
Va.	53,312	1	573	0	0	-	0
W. Va.	20,536	2	432	t	+	0	0
N. C.	50,520	-	-	-	-	-	-
S. C.	29,899	2.5	787	-	-	-	-
Ga.	52,620	2	1,108	-	-	-	-
Fla.	10,500	1	106	-	-	-	-
Ohio	149,097	3	5,083	t	+	1	1,694
Ind.	176,305	0.3	590	-	-	-	-
Ill.	313,074	2	6,996	-	-	0.5	1,749
Mich.	60,716	2	1,239	t	+	-	-
Wis.	98,300	t	+	t	+	0	0
Minn.	131,307	t	+	-	-	-	-
Iowa	455,535	2	9,692	t	+	0	0
Mo.	175,275	-	-	-	-	-	-
N. D.	18,700	3	578	t	+	0	0
S. D.	110,038	3	3,403	0	0	0	0
Nebr.	182,400	-	-	-	-	-	-
Kans.	98,391	5	5,528	-	+	t	+
Ky.	88,066	0.5	452	0	0	-	-
Tenn.	75,440	2	1,640	0	0	t	+
Ala.	50,932	1	542	-	-	-	-
Miss.	51,065	2	1,216	t	+	1	608
La.	29,002	t	+	1	341	1	341
Tex.	114,580	2	2,338	-	-	-	-
Okla.	57,600	-	-	-	-	-	-
Ark.	45,825	3	1,494	t	+	t	+
Mont.	5,475	-	-	-	-	0	0
Wyo.	1,560	-	-	-	-	0	0
Colo.	18,320	2	374	-	-	0	0
N. M.	2,475	-	-	-	-	0	0
Ariz.	1,170	-	-	-	-	0	0
Utah	780	1.5	12	-	-	0	0
Nev.	21	-	-	-	-	0	0
Idaho	1,976	t	+	0	0	0	0
Wash.	2,747	t	+	0	0	0	0
Oreg.	2,277	t	+	-	-	0	0
Calif.	4,176	5	240	t	+	0	0
U.S.	2,390,712	1.6	48,615	t	341	.1	4,392

Estimated reduction in yield of corn due to smut (Ustilago zeae), leaf rust (Puccinia sorghi), brown spot (Physoderma zeae-maydis), root and ear rots (Fusarium spp.) and other diseases, 1922.

State	Production 1922	Root rots		Ear rots		Other diseases		All diseases	
	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)
Me.	1,312	-	-	-	-	-	-	t	-
N. H.	1,032	-	-	-	-	-	-	t	-
Vt.	3,444	-	-	-	-	-	-	2	70
Mass.	2,600	0.5	13	0.5	13	-	-	1 +	26+
R. I.	560	-	-	-	-	-	-	-	-
Conn.	3,465	1	36	0.5	18	2	73	5	182
N. Y.	28,329	4	1,245	2	623	-	-	9 +	2,802+
N. J.	9,912	3	313	0.6	63	-	-	5.1	533
Pa.	69,212	5	3,933	3	2,35[illegible]	1	787	12	9,43[illegible]
Del.	5,439	6	365	3	182	1	61	10.5	63[illegible]
Md.	25,400	10	2,936	1.5	441	-	-	13.5	3,964
Va.	53,312	2	1,147	3	1,720	1	573	7	4,01[illegible]
W. Va.	20,536	1	216	2	432	t	+	5 +	1,080+
N. C.	50,520	-	-	-	-	-	-	-	-
S. C.	29,899	1.5	472	-	-	1	315	5	1,574
Ga.	52,620	-	-	3	1,662	-	-	5	2,770
Fla.	10,500	-	-	-	-	-	-	1	106
Ohio	149,097	2	3,389	4	6,777	2	3,389	12 +	20,33[illegible]+
Ind.	176,305	6	11,793	4	7,862	-	-	10.3 +	20,245
Ill.	313,074	7	24,486	-	-	1	3,498	10.5	36,72[illegible]
Mich.	60,716	t	+	-	-	-	-	2 +	1,239+
Wis.	98,300	0.5	496	0.5	496	t	+	1 +	992+
Minn.	131,307	-	-	-	-	1	1,326	1 +	1,326+
Iowa	455,535	-	-	4	? 19,384	-	-	6 +	29,076+
Mo.	175,275	-	-	-	-	-	-	-	-
N. D.	18,700	t	+	t	+	-	-	3 +	578+
S. D.	110,038	-	-	-	-	-	-	3	3,403
Nebr.	182,400	-	-	-	-	-	-	-	-
Kans.	98,391	1	1,166	3	3,317	2	2,211	11 +	12,162+
Ky.	88,060	-	-	2	1,806	-	-	2.5	2,258
Tenn.	75,440	5	4,100	1	820	-	-	8 +	6,560+
Ala.	50,932	5	2,709	-	-	-	-	6	3,25[illegible]
Miss.	51,065	7	4,25[illegible]	5	3,040	1	608	16	9,72[illegible]
La.	29,002	5	1,706	8	2,730	-	-	15 +	5,11[illegible]+
Tex.	114,580	-	-	-	-	-	-	2	2,33[illegible]
Okla.	57,600	-	-	-	-	-	-	-	-
Ark.	45,825	1	498	3	1,494	1	498	8 +	3,984+
Mont.	5,475	-	-	-	-	-	-	-	-
Wyo.	1,560	-	-	-	-	-	-	-	-
Colo.	18,320	0	0	0	0	0	0	2	374
N. M.	2,475	-	-	-	-	-	-	-	-
Ariz.	1,170	-	-	-	-	-	-	-	-
Utah	781	-	-	-	-	-	-	1.5 +	12
Nev.	21	-	-	-	-	-	-	-	-
Idaho	1,976	t	+	0	0	-	-	t +	+
Wash.	2,747	0	0	0	0	-	-	t +	+
Oreg.	2,277	-	-	-	-	-	-	t +	+
Calif.	4,176	5	240	3	144	-	-	13	624
U. S.	2,890,712	2.1	65,454	1.8	55,383	.4	13,339	6	187,524

Estimated reduction in yield of potatoes due to mosaic, leaf roll, late blight (Phytophthora infestans), Rhizoctonia (Rhizoctonia solani), and black leg (Bacillus atrosepticue), 1922.

State	Production 1922 Bushels (000 omitted)	Mosaic %	Mosaic Bushels 000 omitted	Leaf roll %	Leaf roll Bushels 000 omitted	Late blight %	Late blight Bushels 000 omitted	Rhizoctonia %	Rhizoctonia Bushels 000 omitted	Black leg %	Black leg Bushels 000 omitted
Me.	21,600	5	1,242	1	248	5	1,242	1	248	1	248
N. H.	1,400	5	99	5	99	15	296	1	20	t	+
Vt.	3,000	10	451	2.5	113	15	677	1	45	*-	-
Mass.	2,610	10	360	5	180	10	360	.5	18	t	+
R. I.	270	6	18	-	-	6	18	-	-	*-	-
Conn.	3,360	1	45	1	45	6	272	.5	23	.5	23
N. Y.	37,400	5	2,812	5	2812	7	3,937	5	2,812	t	+
N. J.	16,435	1	188	1.5	282	3	563	t	+	*-	-
Pa.	28,512	2	920	15	6,898	5	2,299	3	1,380	2	920
Del.	960	*-	-	1	10	t	+	-	-	*-	-
Md.	5,151	2	120	2	120	2	120	2	120	t	+
Va.	16,585	3	585	2	390	t	+	3	585	2	390
W. Va.	1,851	*-	-	-	-	2	126	t	+	t	+
N. C.	4,512	-	-	-	-	-	-	-	-	-	-
S. C.	2,508	t	+	t	+	2	55	-	-	t	+
Ga.	1,700	-	-	-	-	1	18	-	-	-	-
Fla.	2,600	*-	-	-	-	*	-	t	+	-	-
Ohio	11,214	*-	-	7	1090	t	+	3	467	-	-
Ind.	5,624	.5	32	5	320	0	0	t	+	t	+
Ill.	7,497	t	+	-	-	0	0	t	+	-	-
Mich.	37,842	3	1,747	5	2,911	2	1,164	5	2,911	t	+
Wis.	40,672	t	+	t	+	t	+	2	924	t	+
Minn.	43,740	1	512	1	512	0	0	2	1,023	2	1,023
Iowa	8,460	*-	-	-	-	0	0	2	238	-	-
Mo.	5,400	5	338	-	-	0	0	5	338	t	+
N. D.	17,820	t	+	-	-	0	0	3	604	2	403

State	Production 1922 Bushels 000 omitted	Estimated reduction in yield due to diseases									
		Mosaic		Leaf roll		Late blight		Rhizoctonia		Black leg	
		%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted
S. D.	8,580	-	-	-	-	-	-	3	330	1	110
Nebr.	11,676	-	-	-	-	0	0	-	-	-	-
Kans.	4,160	.5	26	t	+	0	0	15	790	2	105
Ky.	4,720	10	1,026	30	3,078	0	0	4	411	0	0
Tenn.	2,560	3	84	-	-	5	141	-	-	1	28
Ala.	3,840	-	-	-	-	-	-	-	-	0	0
Miss.	1,360	10	158	-	-	0	0	-	-	-	-
La.	1,755	25	627	-	-	0	0	t	+	0	0
Tex.	2,418	t	+	-	-	0	0	-	-	-	-
Okla.	2,720	-	-	-	-	0	0	-	-	t	+
Ark.	2,380	10	305	-	-	0	0	t	+	-	-
Mont.	5,796	-	-	-	-	0	0	-	-	2	118
Wyo.	2,530	-	-	-	-	0	0	-	-	-	-
Colo.	18,460	-	-	-	-	0	0	-	-	-	-
N. M.	200	-	-	-	-	0	0	-	-	-	-
Ariz.	510	t	+	-	-	0	0	5	29	-	-
Utah	4,137	7	351	-	-	0	0	4	201	2.5	125
Nev.	920	-	-	-	-	0	0	-	-	-	-
Idaho	15,910	10	2,195	3	658	0	0	8	1,756	.5	110
Wash.	9,425	10	1,224	t	+	t	+	8	979	t	+
Oreg.	5,145	10	686	-	-	t	+	8	549	t	+
Calif.	10,260	-	-	-	-	-	-	-	-	-	-
U. S.	451,185	2.8	16,151	3.5	19,766	2	11,288	2.9	16,801	.6	3,603

Estimated reduction in yield of potatoes due to Fusarium wilt (Fusarium oxysporum), tip-burn and hopper-burn, early blight (Macrosporium solani), and other diseases, 1922.

State	Production 1922 Bushels 000 omitted	Estimated reduction in yield due to diseases									
		Fusarium wilt		Tip-burn and hopper-burn		Early blight		Other diseases		All diseases	
		%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted
Me.	21,600	0	0	-	-	-	-	-	-	13	3,228
N. H.	1,400	0	0	-	-	-	-	3	59	29 +	573+
Vt.	3,000	0	0	2	90	3	135	-	-	33.5	1,511
Mass.	2,610	t	+	t	+	t	+	2	72	27.5+	990+
R. I.	270	-	-	-	-	-	-	-	-	12 +	36+
Conn.	3,360	-	-	10	454	2	91	5	227	26	1,180
N. Y.	37,400	1.5	844	5	2,812	t	+	5	2,812	33.5+	18,841+
N. J.	16,435	*-	-	1	188	t	+	6	1,127	12.5+	2,348+
Pa.	28,512	3	1,380	4	1,839	1	460	3	1,380	38	17,476
Del.	960	-	-	4	42	1.5	16	1	10	7.5+	78
Md.	5,151	.5	30	1	60	.5	30	4	240	14 +	840+
Va.	16,585	-	-	1	195	1	195	3	585	15 +	2,925+
W. Va.	4,851	-	-	20	1,260	t	+	1	63	23 +	1,449+
N. C.	4,512	-	-	-	-	-	-	-	-	-	-
S. C.	2,508	t	+	1	27	t	+	5	136	8 +	218+
Ga.	1,700	-	-	-	-	1	18	1.5	26	3.5	62
Fla.	2,600	*-	-	-	-	-	-	-	-	-	-
Ohio	11,214	5	779	12	1,869	t	+	1	156	28 +	4,361+
Ind.	5,624	.5	32	5	320	t	+	1	64	12 +	768+
Ill.	7,497	-	-	3	237	1	79	1	79	5 +	395+
Mich.	37,842	2	1,164	10	5,822	3	1,747	5	2,911	35 +	20,377+
Wis.	40,672	0	0	5	2,311	t	+	5	2,311	12 +	5,546+
Minn.	43,740	.5	256	6	3,069	t	+	2	1,023	14.5+	7,418
Iowa	8,460	6	715	15	1,787	t	+	6	715	29 +	3,455+
Mo.	5,400	-	-	10	675	-	-	-	-	20 +	1,351+
N. D.	17,820	2	403	-	-	.5	101	4	805	11.5+	2,316+

State	Production 1922 Bushels 000 omitted	Estimated reduction in yield due to diseases											
		Fusarium wilt		Tip-burn and hopper-burn		Early blight		Other diseases		All diseases			
		%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted		
S. D.	8,580	2	220	10	1,100	t	+	6	660	22	+	2,420	+
Nebr.	11,676	-	-	-	-	-	-	4	487	4		487	
Kans.	4,160	-	-	*	-	0.5	26	3	158	21	+	1,105	+
Ky.	4,720	1	103	2	205	7	718	-	-	54		5,541	
Tenn.	3,560	-	-	-	-	-	-	-	-	9		253	
Ala.	3,840	-	-	-	-	-	-	-	-	-		-	
Miss.	1,360	1	16	1	16	1	16	1	16	14		222	
La	1,755	0	0	2	50	t	+	3	75	30	+	752	
Tex.	2,418	1	25	*	-	t	+	4	102	5	+	127	+
Okla.	2,720	-	-	*	-	-	-	-	-	-		-	
Ark.	2,380	t	+	3	91	0	0	9	275	22	+	671	+
Mont.	5,796	-	-	-	-	-	-	-	-	2		118	
Wyo.	2,530	-	-	-	-	-	-	-	-	-		-	
Colo.	18,460	-	-	-	-	*	-	-	-	-		-	
N. M.	200	-	-	-	-	-	-	-	-	-		-	
Ariz.	510	-	-	-	-	*	-	6	34	11	+	63	+
Utah	4,137	3.5	175	-	-	0.5	25	-	-	17.5		877	
Nev.	920	-	-	-	-	-	-	-	-	-		-	
Idaho	15,910	1	219	t	+	t	+	5	1,097	27.5	+	6,035	+
Wash.	9,425	t	+	-	-	0	0	5	612	23	+	2,815	+
Oreg.	5,145	t	+	t	+	t	+	7	480	25	+	1,715	+
Calif.	10,260	-	-	-	-	-	-	-	-	-		-	
U. S.	451,185	1.1	6,361	4.3	24,519	.6	3,657	3.3	18,797	21.1		120,943	

Estimated reduction in yield of sweet potatoes due to stem rot (Fusarium hyperoxysporum and F. batatatis), foot rot (Plenodomus destruens), black rot (Sphaeronema fimbriatum), storage rots, pox (Cystospora batatas), and other diseases, 1922.

State	Production 1922 Bushels (000 omitted	Estimated reduction in yield due to diseases: Stem rot %	Stem rot Bushels (000 omitted)	Foot rot %	Foot rot Bushels (000 omitted)	Black rot (Field losses) %	Black rot Bushels (000 omitted)	Storage rots %	Storage rots Bushels (000 omitted)	Pox %	Pox Bushels (000 omitted)	Other diseases %	Other diseases Bushels (000 omitted)	All diseases %	All diseases Bushels (000 omitted)
N. J.	3,500	20	1,037	t	+	2	104	9	467	0.5	26	1	52	32.5+	1,686+
*Pa.	280	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Del.	1,720	6	115	-	-	.5	10	-	-	1.5	29	2	38	10	192
Md.	1,530	4.5	74	t	+	1	16	-	-	0.5	8	1	16	7 +	114+
Va.	6,210	5	388	-	-	5	388	10	776	t	+	-	-	20 +	1,552+
*W. Va.	402	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*N. C.	12,430	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. C.	9,568	t	+	t	+	0.5	50	2	200	-	-	2	200	4.5	450+
Ga.	12,616	0.5	74	-	-	2	295	10	1,476	-	-	2	295	14.5	2,140
*Fla.	2,720	*-	-	-	-	*-	-	-	-	-	-	-	-	-	-
Ohio	360	t	+	-	-	-	-	-	-	-	-	-	-	t	+
Ind.	375	1	4	-	-	t	+	4	16	-	-	-	-	5 +	20+
Ill.	855	-	-	-	-	*-	-	1	9	-	-	-	-	1	9
Iowa	440	7	45	0	0	5	32	20	130	-	-	-	-	32	207
Mo.	1,330	10	148	-	-	-	-	-	-	-	-	-	-	10	148
Kans.	416	15	79	t	+	2	11	2	11	2	11	t	+	21 +	112+
Ky.	2,020	t	+	-	-	15	551	30	1,102	0	0	-	-	45 +	1,653+
Tenn.	4,180	0.5	24	-	-	10	483	3	145	-	-	t	+	13.5+	652+
*Ala.	13,490	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miss.	11,445	12	2,251	-	-	5	938	20	3,752	*-	-	2	375	39	7,316
La.	7,820	t	+	0	0	1	95	15	1,431	t	+	2	191	18 +	1,717+
Tex.	8,715	-	-	-	-	3	331	10	1,103	1	110	7	772	21	2,316
*Okla.	2,052	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ark.	3,760	2	92	0	0	1	46	12	550	t	+	3	138	18 +	826+
N. M.	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ariz.	20	t	+	-	-	t	+	-	-	-	-	5	16	5 +	16+
*Calif.	880	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. S.	109,55[illegible]	#4.4	4,331	-	-	#3.4	3,350	11.3	11,168	#.2	184	#2.1	2,093	21.49	21,126

* - Prod. omitted from figures from which percentage loss for U.S. is calculated.
# - Does not include losses for (Pa., W. Va., N.C., Fla., Ala., Okla., N.M., Calif.) states marked *.

TOMATO

Estimated percentage reduction in yield of tomatoes due to Septoria blight (Septoria lycopersici), Fusarium wilt (Fusarium lycopersici), bacterial wilt (Bacillus solanacearum), early blight (Macrosporium solani), and other diseases, 1922. (Production figures not available.)

State	Estimated percentage reduction in yield due to diseases					
	Septoria blight	Fusarium wilt	Bacterial wilt	Early blight	Other diseases	All diseases
Me.	-	-	0	-	-	-
N. H.	-	-	0	t	1	1 +
Vt.	t	-	0	-	-	t
Mass.	t	t	0	t	5	5 +
R. I.	-	-	0	-	-	-
Conn.	2	1	0	.5	1	4.5
N. Y.	2	2	0	10	15	29
N. J.	5	1	-	3	20	29
Pa.	2	1	0	-	6	9
Del.	45	0.5	-	-	10	55.5
Md.	30	*-	t	t	10	40 +
Va.	30	t	t	2	5	37 +
W. Va.	10	t	t	10	13	33 +
N. C.	-	-	-	-	-	-
S. C.	10	3	1	-	11	25
Ga.	3	2	*-	-	6	11
Fla.	-	-	*-	*-	-	-
Ohio	t	12	-	*-	5	17 +
Ind.	3	4	*0	*-	7	14
Ill.	t	10	-	4	3	17 +
Mich.	5	t	0	t	1	6 +
Wis.	t	*0	0	t	t	t
Minn.	t	0	0	t	1	1 +
Iowa	-	-	0	*-	10	10
Mo.	2	20	-	-	10	32
N. D.	-	-	0	-	-	-
S. D.	-	-	0	-	2	2
Nebr.	-	-	-	-	-	-
Kans.	3	7	-	*-	1	11
Ky.	60	6	-	0	5	71
Tenn.	3	10	-	2	5	20
Ala.	-	-	-	-	-	-
Miss.	t	15	-	3	12	30 +
La.	0	20	1	1	10	32
Tex.	2	8	t	1	3	14 +
Okla.	-	-	-	-	-	-
Ark.	t	20	-	t	5	25 +
Mont.	-	-	0	-	-	-
Wyo.	-	-	0	-	-	-
Colo.	-	-	0	-	-	-
N. M.	-	-	-	-	5	5
Ariz.	0	1	1	-	4	6
Utah	0	*-	0	-	1	4
Nev.	-	-	0	-	3	3
Idaho	0	0	0	0	10	10
Wash.	0	0	0	*0	6	6
Oreg.	-	0	0	-	6	6
Calif.	-	-	0	-	5	5

DRY BEANS

Estimated reduction in yield of dry beans due to anthracnose (Colletotrichum lindemuthianum), bacterial blight (Bacterium phaseoli), mosaic, root rots, and other diseases, 1922

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases: Anthracnose %	Anthracnose Bushels (000 omitted)	Bacterial blight %	Bacterial blight Bushels (000 omitted)	Mosaic %	Mosaic Bushels (000 omitted)	Root rots %	Root rots Bushels (000 omitted)	Other diseases %	Other diseases Bushels (000 omitted)	All diseases %	All diseases Bushels (000 omitted)
N. H.	-	25	+	*-	-	-	-	-	-	-	-	25	+
Vt.	-	5	+	10	+	*-	-	1	+	-	-	16	+
Mass.	-	3	+	1	+	t	+	1	+	t	+	5	+
Conn.	-	1	+	3	+	.5	+	.5	+	-	-	5	+
N. Y.	1,302	3	45	4	59	2	30	3	45	0.5	7	12.5	186
Pa.	-	6	+	4	+	2	+	3	+	-	-	15	+
Del.	-	.5	+	1	+	*-	-	-	-	0.5	+	2	+
Md.	-	-	-	1.5	+	t	+	t	+	-	-	1.5	+
Va.	-	2	+	1	+	-	-	t	+	1	+	4	+
W. Va.	-	4	+	t	+	-	-	t	+	1	+	5	+
S. C.	-	t	+	2	+	-	-	t	+	2	+	4	+
Ga.	-	1	+	1	+	-	-	-	-	5	+	7	+
Ohio	-	4	+	2	+	-	-	-	-	2	+	8	+
Ind.	-	-	-	2	+	3	+	-	-	-	-	5	+
Ill.	-	t	+	t	+	-	-	t	+	-	-	+	+
Mich.	4,809	2	117	10	587	1	59	5	293	t	+	18	1,056+
Wis.	76	1	1	1	1	t	+	0	0	t	+	2	2+
Minn.	-	t	+	2	+	2	+	t	+	-	-	4	+
Iowa	-	.5	+	2.5	+	2	+	-	-	-	-	5	+
Mo.	-	-	+	-	-	-	-	-	-	-	-	3	+
N. D.	-	t	+	0	0	-	-	-	-	-	-	t	+
S. D.	-	5	+	-	-	-	-	*-	-	-	-	5	+
Tenn.	-	2	+	2	+	1	+	-	-	-	-	5	+
Miss.	-	-	+	3	+	1	+	1	+	1	+	11	+

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases															
		Anthracnose		Bacterial blight		Mosaic		Root rots		Other diseases		All diseases					
		%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%	Bushels (000 omitted)	%		Bushels (000 omitted)			
La.	-	1	+	3	+	t	+	t	+	2	+	6	+	+			
Tex.	-	-	-	t	+	-	-	-	-	15	+	15	+	+			
*Colo.	405	-	-	-	-	-	-	-	-	-	-	-	-	-			
*N. M.	135	-	-	-	-	-	-	-	-	-	-	-	-	-			
Ariz.	24	-	+	1	+	-	-	-	-	5	+	6	+	+			
Utah	-	-	-	-	-	1	+	-	-	-	-	1	+				
Idaho	364	0	0	0	0	5	19	-	-	t	+	5	+	19	+		
Wash.	-	0	0	0	0	2	+	-	-	5	+	7	+	+			
Oreg.	-	-	-	t	+	10	+	-	-	-	-	10	+	+			
*Calif.	4,778	-	-	-	--	-	-	-	-	-	-	-	-	-			
U. S.	11,893	#2	163	#8.3	647	#1.4	108	#4.3	338	#0.1	7	#16.1		1,263			

* - No loss estimates received; not included in calculations for U. S. Loss.
\# - Does not include losses in states marked *.

Estimated reduction in yield of cotton due to anthracnose (Colletotrichum gossypii), angular leaf spot (Bacterium malvacearum), Fusarium wilt (Neocosmospora vasinfectum), root knot (Heterodera radicicola), and other diseases, 1922.

State	Production 1922 Bales (000 omitted	Estimated reduction in yield due to disease: Anthracnose %	Anthracnose Bales (000 omitted	Angular leaf spot %	Angular leaf spot Bales (000 omitted	Fusarium wilt %	Fusarium wilt Bales (000 omitted	Root Knot %	Root Knot Bales (000 omitted	Other diseases %	Other diseases Bales (000 omitted	All diseases %	All diseases Bales (000 omitted
Va.	25	1	+	t	+	1	+	t	+	-	-	2	+
*N. C.	852	-	-	-	-	-	-	-	-	-	-	-	-
S. C.	530	1	6	t	+	5	29	-	-	2	11	8	46
Ga.	725	1	8	3	24	2	16	2	16	2	16	10	80
*Fla.	25	-	-	-	-	-	-	-	-	-	-	-	-
*Mo.	149	-	-	-	-	-	-	-	-	-	-	-	-
Tenn.	400	2	9	1	4	-	-	-	-	5	22	8	35
*Ala.	858	-	-	-	-	-	-	-	-	-	-	-	-
Miss.	1,610	2	22	1	11	5	55	-	-	-	-	8	88
La.	357	3	11	1	4	2	6	t	+	1	4	7	25
*Tex.	3,290	-	-	-	-	-	-	-	-	-	-	-	-
*Okla.	635	-	-	-	-	-	-	-	-	-	-	-	-
Ark.	1,020	.5	6	1	12	5	59	2	23	3	35	11.5	135
Ariz.	42	-	-	7.5	4	-	-	-	-	5	2	12.5	6
*Calif.	85	-	-	-	-	-	-	-	-	-	-	-	-
*Others	15	-	-	-	-	-	-	-	-	-	-	-	-
U. S.	9,961	1.4	62	1.3	59	3.7	167	.9	39	2	90	9.8	417

* - No loss estimates are available for these states; their production is not included in the total from which the percentage loss in the U. S. is calculated.

APPLE

Estimated reduction in yield of apples due to bitter rot (Glomerella cingulata), black rot (Physalospora cydoniae), blotch (Phyllosticta solitaria), and cedar rust (Gymnosporangium juniperi-virginianae), 1922.

State	Production: 1922	Estimated reduction in yield due to diseases							
		Bitter rot		Black rot		Blotch		Cedar rust	
	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)
Me.	1,250	0	0	-	-	0	0	-	-
N. H.	775	t	+	t	+	0	0	t	+
Vt.	960	-	-	-	-	0	0	-	-
Mass.	3,010	-	-	.5	16	0	0	t	+
R. I.	200	-	-	-	-	0	0	-	-
Conn.	1,300	.5	7	2	30	0	0	.5	7
N. Y.	36,000	t	+	2.5	1,4[illegible]3	0	0	4	2,380
N. J.	2,610	-	-	-	-	1	27	1	27
Pa.	11,400	t	+	.5	140	1.5	269	t	+
Del.	980	1	23	.5	12	3	70	1.5	35
Md.	1,800	1	21	5	107	1.5	32	1.5	32
Va.	8,360	1	133	1	133	2	265	10	1,327
W. Va.	5,625	.5	33	2	154	t	+	1.5	100
N. C.	5,570	-	-	-	-	-	-	-	-
S. C.	383	5	21	-	-	-	-	t	+
Ga.	1,135	5	68	2	27	-	-	-	-
Ohio	7,298	1	97	7	677	5	483	.5	48
Ind.	4,148	.25	12	3	139	2	93	.1	5
Ill.	9,720	t	+	2	242	6	725	.5	60
Mich.	11,850	-	-	-	-	0	0	-	-
Wis.	2,024	0	0	t	+	0	0	t	+
Minn.	1,020	0	0	t	+	0	0	t	+
Iowa	4,410	-	-	2	106	3	160	-	-
Mo.	9,400	3.5	341	-	-	t	+	-	-
N. D.	-	-	-	-	-	0	0	-	-
S. D.	263	-	-	-	-	0	0	t	+
Nebr.	1,620	-	-	-	-	-	-	-	-
Kans.	3,280	-	-	-	-	10	418	.5	21
Ky.	5,070	-	-	-	-	10	674	1	87
Tenn.	4,250	15	1,081	5	360	8	576	t	+
Ala.	1,038	-	-	-	-	-	-	-	-
Miss.	216	3.5	9	-	-	6	15	t	+
La.	37	t	+	t	+	t	+	t	+
Tex.	2,640	-	-	.5	14	2	55	-	-
Okla.	1,140	-	-	-	-	-	-	-	-
Ark.	2,400	1	27	.25	7	3	80	t	+
Mont.	610	0	0	0	0	0	0	0	0
Wyo.	45	0	0	0	0	0	0	0	0
Colo.	4,250	0	0	0	0	0	0	0	0
N. M.	750	0	0	0	0	0	0	0	0
Ariz.	77	0	0	0	0	0	0	0	0
Utah	1,085	0	0	0	0	0	0	0	0
Nev.	35	0	0	0	0	0	0	0	0
Idaho	3,900	0	0	0	0	0	0	0	0
Wash.	25,678	0	0	0	0	0	0	0	0
Oreg.	6,300	0	0	0	0	0	0	0	0
Calif.	7,656	0	0	0	0	0	0	0	0
U. S.	203,628	.7	1,873	1.5	3,941	1.6	4,142	1.6	4,129

APPLE (Continued)

Estimated reduction in yield of apples due to fire blight (Bacillus amylovorus), scab (Venturia inaequalis), and other diseases, 1922.

State	Production: 1922	Estimated reduction in yield due to diseases: Fire blight		Scab		Other diseases		All diseases	
	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)	%	Bus. (000 omitted)
Me.	1,250	-	-	-	-	-	-	-	-
N. H.	775	t	+	15	137	-	-	15 +	137
Vt.	960	5	54	6	65	-	-	11	119
Mass.	3,010	-	-	5	159	-	-	5.5	175
R. I.	200	-	-	-	-	-	-	-	-
Conn.	1,300	2	30	5	74	2	30	12	178
N. Y.	36,000	6	3,570	22	13,091	5	2,375	39.5+	23,504+
N. J.	2,610	-	-	-	-	-	-	2	54
Pa.	11,400	2.5	449	30	5,386	-	-	36.5+	6,553+
Del.	930	-	-	2	47	50	1,167	58	1,354
Md.	1,800	2	43	4	86	1	21	16	342
Va.	8,360	1	133	15	1,990	7	929	37	4,910
W. Va.	5,625	1	67	6	402	5	335	16 +	1,071+
N. C.	5,570	-	-	-	-	-	-	-	-
S. C.	383	1	4	t	+	3	13	9 +	38+
Ga.	1,135	3	41	6	81	-	-	16	217
Ohio	7,298	1	97	8	773	2	193	24.5	2,368
Ind.	4,148	.1	5	4	185	1.1	51	10.55	490
Ill.	9,720	1	121	7	845	3	362	19.5+	2,355+
Mich.	11,850	-	-	16	2,257	-	-	16	2,257
Wis.	2,024	5	112	5	112	t	+	10 +	224+
Minn.	1,020	.5	5	5	54	-	-	5.5+	59
Iowa	4,410	2	106	10	531	-	-	17	903
Mo.	9,400	-	-	-	-	-	-	3.5	341
N.D.	-	5	+	2	+	-	-	7	+
S.D.	263	10	31	2	6	2	6	14 +	43+
Nebr.	1,620	-	-	-	-	-	-	-	-
Kans.	3,280	1	42	5	209	5	209	21.5	899
Ky.	5,070	15	1,311	15	1,311	1	87	42	3,670
Tenn.	4,250	t	+	12	864	1	72	41 +	2,953+
Ala.	1,098	-	-	-	-	-	-	-	-
Miss.	216	5	13	-	-	-	-	14.5+	37+
La.	37	t	+	-	-	-	-	+	+
Tex.	2,640	2	55	-	-	-	-	4.5	124
Okla.	1,140	-	-	-	-	-	-	-	-
Ark.	2,400	2	53	.5	13	3.5	94	10.25+	274+
Mont.	610	-	-	-	-	-	-	-	-
Wyo.	45	-	-	-	-	-	-	-	-
Colo.	4,250	-	-	-	-	-	-	-	-
N. M.	750	-	-	-	-	-	-	-	-
Ariz.	77	1	1	-	-	5	4	6	5
Utah	1,085	.5	5	-	-	*	-	.5	5
Nev.	35	-	-	-	-	-	-	-	-
Idaho	3,900	2	82	t	+	3	123	5 +	205
Wash.	25,678	t	+	.3	85	9	2,548	9.3+	2,633+
Oreg.	6,300	t	+	5	346	4	277	9 +	623+
Calif.	7,656	-	-	-	-	-	-	-	-
U. S.	203,628	2.4	6,430	11.1	29,109	3.6	9,496	22.5	59,120

Estimated reduction in yield of peaches due to leaf curl (Exoascus deformans), brown rot (Sclerotinia cinerea), scab (Cladosporium carpophilum), and other diseases, 1922.

State	Production 1922	Estimated reduction in yield due to diseases											
		Leaf curl		Brown rot		Scab		Other diseases		All diseases			
	Bushels :000 omitted	%	Bushels :000 omitted	%	Bushels :000 omitted	%	Bushels :000 omitted	%	Bushels :000 omitted	%	Bushels :000 omitted		Bushels :000 omitted
N. H.	32	-	-	-	-	-	-	-	-	-	-		-
Mass.	200	2	4	10	23	t	+	-	-	12	+		27+
R. I.	28	-	-	-	-	-	-	-	-	-	-		-
Conn.	262	1	3	10	31	2	6	2	6	15			46
N. Y.	3,400	6	253	10	422	1.5	63	2	85	19.5			623
N. J.	2,000	-	-	1	20	-	-	-	-	1			20
Pa.	1,560	2	40	10	199	2	40	7.5	149	21.5			428
Del.	320	-	-	1	4	3	11	5.5	20	10			35
Md.	495	1.5	8	4	22	2	11	3	17	10.5			58
Va.	764	0	0	8	71	3	27	3	27	14			125
W. Va.	715	t	+	10	81	t	+	2	16	12	+		97+
N. C.	1,008	-	-	-	-	-	-	-	-	-	-		-
S. C.	845	t	+	49	963	-	-	8	157	57	+		1,120+
Ga.	4,900	.5	28	5	283	3	170	5	283	13.5			764
Fla.	130	-	-	-	-	-	-	-	-	-	-		-
Ohio	1,564	5	95	7	134	3	57	2	38	17			324
Ind.	650	.5	3	1	7	-	-	3	20	4.5			30
Ill.	1,100	2	23	1.5	18	t	+	2	23	5.5	+		64+
Mich.	1,440	2	32	3	47	2	32	2	32	9			143
Iowa	200	2	4	-	-	-	-	-	-	2			4
Mo.	2,300	6	147	-	-	-	-	-	-	6			147
Nebr.	81	-	-	-	-	-	-	-	-	-	-		-
Kans.	630	10	79	5	39	5	39	-	-	20			157
Ky.	1,218	6	348	35	2,030	30	1,740	8	464	79			4,582
Tenn.	2,002	-	-	5	107	1	21	-	-	6			128
Ala.	810	-	-	-	-	-	-	-	-	-	-		-
Miss.	375	-	-	15	67	1.5	7	-	-	16.5			74

State	Production 1922	Estimated reduction in yield due to diseases											
		Leaf curl		Brown rot		Scab		Other diseases		All diseases			
	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted		
La.	180	0	0	20	49	2	5	5	12	27	66		
Tex.	1,920	-	-	1	20	1	20	-	-	2	40		
Okla.	2,070	-	-	-	-	-	-	-	-	-	-		
Ark.	2,040	2	52	10	258	3	77	6	155	21	542		
Colo.	1,160	-	-	-	-	-	-	-	-	-	-		
N. M.	98	-	-	-	-	-	-	-	-	-	-		
Ariz.	128	6	9	-	-	-	-	5	7	11	16		
Utah	885	-	-	-	-	-	-	-	-	-	-		
Nev.	6	-	-	-	-	-	-	-	-	-	-		
Idaho	244	t	+	0	0	0	0	t	+	+	+		
Wash.	1,125	.5	6	.1	1	0	0	5	60	5.6	67		
Oreg.	300	3	11	2	7	-	-	10	35	15	53		
Calif.	17,500	-	-	-	-	-	-	15	3,088	15	3,088		
U. S.	56,705	1.6	1,145	7	4,903	3.3	2,326	6.7	4,694	18.6	13,068		

Estimated reduction in yield of pears due to fire blight (Bacillus amylovorus), scab (Venturia pyrina), leaf blight (Fabraea maculata), and other diseases, 1922.

State	Production 1922 Bushels (000 omitted)	Estimated reduction in yield due to diseases: Fire blight %	Fire blight Bushels 000 omitted	Scab %	Scab Bushels 000 omitted	Leaf blight %	Leaf blight Bushels 000 omitted	Other diseases %	Other diseases Bushels 000 omitted	All diseases %	All diseases Bushels 000 omitted
Me.	14	-	-	-	--	-	-	-	-	-	-
N. H.	24	t	+	-	-	-	-	-	-	t	+
Vt.	10	3	+	5	+	-	-	-	-	8	+
Mass.	84	-	-	-	-	-	-	-	-	-	-
R. I.	12	-	-	-	-	-	-	-	-	-	-
Conn.	60	5	3	1	1	1	1	-	-	7	5
N. Y.	3,200	18	758	6	253	-	-	-	-	24	1,011
N. J.	405	-	-	-	-	-	-	-	-	-	-
Pa.	576	-	-	12	79	-	-	-	-	12	79
Del.	158	3	5	-	-	5	9	-	-	8	14
Md.	256	8	24	1	3	5	15	t	+	14	42+
Va.	270	-	-	-	-	-	-	-	-	-	-
W. Va.	38	5	2	t	+	t	+	t	+	5	2+
N. C.	110	-	-	-	-	-	-	-	-	-	-
S. C.	104	50	109	-	-	-	-	2	4	52	113
Ga.	202	-	-	-	-	-	-	-	-	-	-
Fla.	50	-	-	-	-	-	-	-	-	-	-
Ohio	450	3	14	2	9	t	+	-	-	5	23+
Ind.	300	-	-	-	-	-	-	-	-	-	-
Ill.	510	5	27	t	+	t	+	2	11	7	38+
Mich.	672	10	75	-	-	-	-	-	-	10	75
Wis.	19	t	+	t	+	0	0	t	+	+	+
Iowa	75	-	-	-	-	-	-	-	-	-	-
Mo.	450	-	-	-	-	-	-	-	-	-	-
S. D.	---	15	+	1	+	-	-	-	-	16	+

State	Production 1922 Bushels 000 omitted	Estimated reduction in yield due to diseases									
		Fire blight		Scab		Leaf blight		Other diseases		All diseases	
		%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted	%	Bushels 000 omitted
Nebr.	27	-	-	-	-	-	-	-	-	-	-
Kans.	243	-	-	-	-	-	-	-	-	-	-
ky.	150	65	279	-	-	t	+	-	-	65 +	279+
Tenn.	180	t	+	t	+	t	+	t	+	+	+
Ala.	176	-	-	-	-	-	-	-	-	-	-
Miss.	190	-	-	-	-	-	-	-	-	-	-
La.	48	40	32	-	-	-	-	-	-	40	32
Tex.	390	-	-	-	-	-	-	-	-	-	-
Okla.	197	-	-	-	-	-	-	-	-	-	-
Ark.	100	60	150	-	-	-	-	t	+	60+	150
Mont.	9	-	-	-	-	-	-	-	-	-	-
Colo.	519	-	-	-	-	-	-	-	-	-	-
N. M.	18	-	-	-	-	-	-	-	-	-	-
Ariz.	18	1	+	-	-	-	-	5	+	6	+
Utah	98	-	-	-	-	-	-	-	-	-	-
Nev.	4	-	-	-	-	-	-	-	-	-	-
Idaho	72	2	1	0	0	0	0	t	+	2 +	1+
Wash.	1,708	t	+	.5	9	0	0	8	149	8.5+	158+
Oreg.	1,260	2	26	1	13	-	-	1	13	4 +	52+
Calif.	5,205	15	919	-	-	-	-	-	-	15	919
U. S.	14,818	13.6	2,424	2.1	367	.1	25	1	177	16.8	2,993

Note: Production in states from which no loss estimates were received has been omitted from total on which percentage loss in United States is based.

PLUM and PRUNE

Estimated reduction in yield of plums and prunes due to brown rot (Sclerotinia cinerea), and other diseases, 1922.

State	Estimated reduction in yield due to diseases		
	Brown rot	Other diseases	All diseases
	%	%	%
Me.	-	-	-
N. H.	-	-	-
Vt.	15	-	-
Mass.	-	-	-
R. I.	-	-	-
Conn.	15	2	17
N. Y.	12	-	-
N. J.	-	-	-
Pa.	15	5	20
Del.	2	.5	2.5
Md.	6	3	9
Va.	-	-	-
W. Va.	5	5	10
N. C.	-	-	-
S. C.	5	2	7
Ga.	-	-	-
Fla.	-	-	-
Ohio	10	3	13
Ind.	-	-	-
Ill.	5	2	7
Mich.	-	-	-
Wis.	5	1	6
Minn.	1.5	.5	2
Iowa	20	-	-
Mo.	-	-	-
N. D.	*-	-	-
S. D.	-	-	-
Nebr.	-	-	-
Kans.	5	1	6
Ky.	-	-	-
Tenn.	30	-	30
Ala.	-	-	-
Miss.	-	-	-
La.	-	-	-
Tex.	10	-	-
Okla.	-	-	-
Ark.	20	t	20 +
Mont.	-	-	-
Wyo.	-	-	-
Colo.	-	-	-
N. M.	-	-	-
Ariz.	-	5	5
Utah	-	-	-
Nev.	-	-	-
Idaho	0	3	3
Wash.	t	5	5
Oreg.	*-	-	-
Calif.	-	-	-

CHERRY

Estimated reduction in yield of cherries due to brown rot (Sclerotinia cinerea), leaf spot (Coccomyces hiemalis), and other diseases, 1922.

State	Estimated reduction in yield due to diseases			
	brown rot:	Leaf spot:	Other diseases:	All diseases
	%	%	%	%
Mass.	-	*-	-	-
Conn.	15	*-	2	17
N. Y.	8	6	-	-
Pa.	10	9	-	-
Del.	2	1	-	3
Md.	3	8	1	12
Va.	-	*-	-	-
W. Va.	5	t	5	10+
Ohio	2	25	-	27
Ind.	t	5	-	5
Ill.	1	t	1	2+
Mich.	-	20	-	20
Wis.	t	5	t	5
Iowa	-	6	-	6
Mo.	-	*-	-	-
Kans.	2	5	-	7
Ky.	10	15	-	25
Tenn.	5	-	t	5+
Ark.	4	5	t	9+
Idaho	-	-	1	1
Wash.	.5	0	5	5.5

GRAPE

Estimated reduction in yield of grapes due to black rot (Guignardia bidwellii), and other diseases, 1922.

State	Estimated reduction in yield due to diseases: Black rot	Other diseases	All diseases	State	Black rot	Other diseases	All diseases
	%	%	%		%	%	%
N. H.	t	-	-	Minn.	t	1	1.5
Conn.	20	5	25	Iowa	5	-	5
N. Y.	2	-	2	Kans.	2	2	4
Pa.	5	-	-	Ky.	25	15	40
Del.	5	-	5	Tenn.	20	t	20 +
Md.	10	5	15	Miss.	5	-	5
W. Va.	20	-	20	La.	t	-	t
S. C.	12.5	3	15.5	Tex.	8	-	8
Ga.	10	10	20	Ark.	8	1	9
Ohio	5	3	8	Ariz.	-	4	4
Ind.	2	-	2	Idaho	-	-	-
Ill.	3	1	4	Wash.	0	5	5
Wis.	5	1	6				

RASPBERRY

Estimated reduction in yield of raspberries due to Mosaic and Leaf curl (cause unknown), and other diseases, 1922.

State	Estimated reduction in yield due to diseases: Mosaic and Leaf curl	Other diseases	All diseases	State	Mosaic and Leaf curl	Other diseases	All diseases
	%	%	%		%	%	%
Conn.	10	10	20	Minn.	2	3	5
Pa.	12.5	5	17.5	Kans.	-	7	7
Md.	2	7	9	Ky.	-	95	95
W. Va.	-	5	5	Ark.	0	30	30
Ohio	-	20	20	Wash.	0	10	10
Ind.	-	10	10	Wis.	1	t	1

INDEX TO SUPPLEMENTS XXVI - XXX, PLANT DISEASE BULLETIN, 1923.

Plant Disease Reporter
Supplement 31

December 31, 1923

Prepared by Mary G. Van Meter

Abies amabilis, (see silver fir), 394.
balsamea, (see balsam fir), 395.
grandis, (see lowland fir), 395.
lasiocarpa, (see Alpine fir), 395.
veitchii, (see Veitch's fir), 395.
Abnormal proliferated blossoms, watermelon, 123.
Aborted nuts, white elm, 416.
Acacia farnesiana, (see acacia), 409.
Acacia, Ravenelia australis, 409.
Acer glabrum, (see dwarf maple), 420.
interior, (see maple), 421.
macrophyllum, (see Oregon maple), 421.
negundo, (see box elder), 421.
pennsylvanica, (see striped maple), 421.
platanoides, (see Norway maple), 421.
rubrum, (see red maple), 421.
tar leaf spot, 423.
saccharinum, (see silver maple), 422.
tar leaf spot, 423.
saccharum, (see sugar maple), 422.
spicatum, (see mountain maple), 422.
spp., (see maple), 422.
Acreage of United States, 240.
Acrostalagmus caulophagus, blackberry, 373.
raspberry, 371.
Actinomyces scabies, beet, 144.
potato, 24.
sugar beet, 134.
Actinonema rosae, rose, 445.
sp., poinsettia, 443.
Aecidium abundans, snowberry, 449.
gossypii, cotton, 128.
ivae, marsh elder, 415.
oxalidis, oxalis, 442.
Aesculus californica, (see California buckeye), 411.
glabra, (see buckeye), 411.
hippocastanum, (see horse chestnut), 419.
Agropyron acutum, Puccinia glumarum, 263.
caninum, Puccinia graminis, 263.
elongatum, Helminthosporium giganteum, 261.
intermedium, Helminthosporium giganteum, 261.
longifolium, Puccinia glumarum, 263.
repens, Claviceps purpurea, 261.
Erysiphe graminis, 261.
Helminthosporium giganteum, 261.
Ophiobolus cariceti, 262.
Phyllachora graminis, 262.
Puccinia graminis, 263.
Urocystis agropyri, 264.
smithii, Claviceps purpurea, 261.
Puccinia graminis, 263.
Wojnowicia graminis, 265.
spp., Puccinia clematidis, 262.
tenerum, Erysiphe graminis, 261.
Puccinia clematidis, 262.
Puccinia graminis, 263.
tenerum longifolium, Puccinia glumarum, 263.

Agrostis palustris, Erysiphe graminis, 261.
Ophiobolus cariceti, 167, 262.
Puccinia graminis, 263.
Pythium sp., 166, 264.
Urocystis agropyri, 167, 264.
stolonifera, Helminthosporium giganteum, 261.
Albugo candida, Bursa bursa-pastoris, 451.
horseradish, 110.
mustard, 110.
radish, 111.
turnip, 111.
ipomoeae panduranae, sweet potato, 88.
tragopogonis, salsify, 161.
Alder, mountain, catkin deformation, 409.
leaf spot, 409.
powdery mildew, 409.
Alder, red, canker, 409.
leaf spot, 409.
white heart rot, 409.
Alfalfa, anthracnose, 248.
bacterial blight, 248.
crown wart, 248.
dodder, 249.
downy mildew, 248.
girdle, 249.
leaf spot, 166.
Ascochyta, 249.
Cercospora, 249.
Macrosporium, 249.
Pleosphaerulina, 249.
Pseudopeziza, 246.
root knot, 249.
root rot, 249, 253.
Ozonium, 248.
Sclerotinia, 248.
rust, 166, 247.
Uromyces striatus, 167.
violet root rot, 249.
white top, 249.
yellow leaf blotch, 248.
yellows, 249.
Almond, crown gall, 391.
root knot, 391.
Alnus oregona, (see red alder), 409.
tenuifolia, (see mountain alder), 409.
Alopecurus geniculatus, Puccinia graminis, 263.
pratensis, Scolecotrichum graminis, 264.
Alsike clover, (see clover), 250, 253.
Alternaria, apple, 314.
atrans, cowpea, 166, 256.
soybean, 166, 257.
brassicae, cabbage, 107.
cucumber, 118.
brassicae nigrescens, cantaloupe, 112.
watermelon, 123.
cabbage, 5.
cantaloupe, 6.
crassa, Datura stramonium, 452.
Datura tatula, 453.
dianthi, carnation, 434.
lettuce, 3.
radicina, carrot, 145.
rhubarb, 2.
(see Macrosporium catalpae), 412.
sp., apple, 314.
cotton, 128.
golden seal, 454.
lettuce, 153.
palm, 442.
pepper, 160.
persimmon, 387.
tobacco, 143.
tomato, 3, 67.
wheat, 214.
Alternaria spot, tomato, 67.
Alternariose, carnation, 434.
Althaea rosea, (see hollyhock), 438.
Amelanchier alnifolia, (see western service berry), 429.
sp., (see service berry), 429.
Amerosporium oeconomicum, cowpea, 256.
Ampelopsis, leaf spot, 432.
powdery mildew, 432.
quinquefolia, (see ampelopsis), 432.
tricuspidata, (see ampelopsis), 432.
Amphisphaeria decclorans, willow, 431.
Anemone, rust, 342.
Angelinia rufescens, oak, 426.
Angular leaf spot, bean, 96.
cotton, 125, 481.
cucumber, 117.
Angular spot, tobacco, 2, 137.
Ant canker, white pine, 404.
Anthostomella destruens, cranberry, 375.
Anthracnose, alfalfa, 248.
apple, 305.
barley, 224.

basswood, 410.
bean, 4, 91, 479, 480.
blackberry, 372.
camphor, 412.
cantaloupe, 112.
choke cherry, 413.
citron, 114.
citrus, 381.
clover, 254.
corn, 240.
cotton, 123, 481.
cucumber, 117.
currant, 373.
elm, 416, 417.
Euonymus spp., 436.
fig, 385.
gooseberry, 374.
grape, 359.
guava, 387.
hickory, 419.
lettuce, 154.
lima bean, 97.
mango, 387.
oak, 425.
oats, 230.
onion, 99.
pea, 159.
pecan, 390.
pine, 407.
poplar, 428.
potato, 46.
raspberry, 367.
rye, 166, 217.
slippery elm, 416.
snapdragon, 448.
sorghum, 246.
spinach, 162.
Sudan grass, 260.
sugar maple, 422.
sweet clover, 255.
sycamore, 429.
tomato, 66.
watermelon, 6, 120.
wheat, 166, 209.
white elm, 416.
white oak, 424.
wild rose, 446.
wing elm, 415.
Antirrhinum spp., (see snapdragon), 447.
Aphelenchus olesistus, chinese cabbage, 3.
Aphid injury, cowpea, 256.
soybean, 257.
Aplanobacter michiganense, tomato, 65.
rhizoctonia, lettuce, 152.
stewartii, corn, 237.
Apple, anthracnose, 305.
arsenical injury, 317.
bark cankers, 314.
bitter pit, 311, 319, 320.
bitter rot, 288, 319, 320, 482.
black rot, 291, 319, 320, 482.
blister canker, 290, 319.
blotch, 283, 319, 320, 482.
blue mold rot, 313.
brown rot, 314.
canker, 314, 315.
miscellaneous bark, 314.
Septobasidium, 315.
cedar rust, 482.
cloud, 319, 320.
collar rot, 304.
copper injury, 316.
crop losses, 462, 482, 483.
crown gall, 308.
Cytospora canker, 315.
drought injury, 315.
drought spot, 315.
dry rot, 314.
dusting versus spraying, 318.
Eruopean canker, 306.
fire blight, 299, 319, 483.
fly-speck, 309.
frog-eye, 293.
frost injury, 273.
fruit spot, 304.
growth cracks, 316.
heart rots, 315.
imperfect pollination, 316.
increase in production, 268, 273.
jonathan spot, 312.
leaf spot, 314.
lenticel proliferation, 315.
measles, 315.
miscellaneous bark cankers, 314.
fruitirots, 313.
leaf spots, 313.
non-parasitic diseases, 315.
orchard disease survey, 318.
Phytophthora syringae, 314,
pink rot, 313.
powdery mildew, 306.
pox canker, 315.
ripe rot, 314.
root rot, 310, 311.
Armillaria, 311.

Hypholoma, 311.
Ozonium, 311.
Xylaria, 310.
rosette, 315.
rot, Alternaria, 314.
Botrytis, 314.
Cephalosporium, 314.
Dothichiza, 314.
Fusarium, 314.
Penicillium, 314.
Phoma, 314.
Phyllosticta, 314.
Rhizopus, 314.
rust, 294, 319, 320.
scab, 273, 319, 320, 483.
sooty blotch, 309.
spongy dry rot, 314.
spray burn, 319, 320.
spray injury, 316.
sunburn canker, 315.
sun scald, 315.
water core, 312.
wind injury, 316.
winter injury, 316.
Apricot, bacterial spot, 356.
blight, 356.
brown rot, 355.
crown gall, 356.
frost injury, 356.
root knot, 356.
scab, 356.
shot hole, 356.
Arborvitae, giant, cedar leaf blight, 394.
Coryneum juniperinum, 394.
red brown heartwood butt rot, 394.
Phomopsis juniperovora, 394.
wood rot, 394.
Arbutus menziesii, (see madrona), 420.
Arctostaphylos manzanita, (see manzanita), 457.
uva-ursi, (see kinnikinnick), 456.
Armillaria mellea, apple, 310, 311.
potato, 48.
scarlet oak, 424.
sp., peach, 344.
Arsenical injury, apple, 317.
Artichoke, Botrytis rot, 143.
Ascochyta blight, pea, 156.
caulicola, sweet clover, 255.
colorata, (see Mollisia earliana), 363.
colorata, strawberry, 364.
fragariae, (see Mollisia earliana), 363.
strawberry, 364.
gossypii, cotton, 128.
medicaginis, alfalfa, 249.
rhei, rhubarb, 2, 160.
sp., hollyhock, 439.
Ash, green, rust, 409.
Ash, heart rot, 410.
leaf spots, 410.
rust, 410.
Ash, mountain, canker, 410.
frost injury, 410.
rust, 410.
Ash, Oregon, leaf blight, 410.
Ash, red, leaf spot, 410.
Ash, white, rust, 409.
wood rot, 409.
Asparagus fern, Fusarium sp., 432.
Phoma sp., 432.
Physarum sp., 433.
Asparagus, Fusarium rot, 144.
rust, 4, 143.
stem spot, 144.
twig canker, 144.
Asparagus plumosus, (see asparagus fern), 433.
Aspergillus niger, corn, 240.
fig, 385.
onion, 100.
Aster, China, Philospora sp., 433.
rust, 433.
wilt, 433.
yellows, 433.
Aster sp., rust, 451.
Avena fatua, halo blight, 230.
sp., Puccinia coronata, 262.
Averrhoa carambola, literature, 388.
Avocado, black spot, 386.
Pestalozzia sp., 386.
scab, 386.

B

Bachelor's button, rust, 433.
Bacillus amylovorus, apple, 299, 483,
hawthorn, 418.
loquat, 388.
pear, 322, 486, 487.
Prunus triloba plena, 325, 444.
quince, 329.
service berry, 429.

aroideae, calla lily, 434.
atrosepticus, potato, 473, 474.
carotovorus, cabbage, 108.
calla lily, 434.
carrot, 5, 145.
celery, 148.
iris, 439.
violet, 450.
lathyri, horse bean, 259.
lima bean, 97.
nelliae, parsley, 155.
phytophthorus, potato, 28.
solanacearum, (see Bacterium solanacearum), 478.
sorghi, sorghum, 245.
Sudan grass, 246, 260.
sp., horseradish, 110.
tracheiphilus, cantaloupe, 112, 114.
cucumber, 114.
squash, 119.
Bacteria, elm, 417.
lettuce, 2.
potato, 48.
swiss chard, 3.
Bacterial disease, lettuce, 152.
swiss chard, 3, 163.
Bacterial gummosis, cherry, 354.
plum, 350.
Bacterial pustule, soybean, 256.
Bacterial rosette, lettuce, 152.
Bacterial shot hole, peach, 341.
Bacterial spot, apricot, 356.
cowpea, 256.
lettuce, 152.
peach, 340.
pepper, 160.
plum, 349.
tomato, 66.
Bacterial stalk rot, corn, 166, 168.
Bacterium angulatum, tobacco, 137.
apii, celery, 148.
aptatum, swiss chard, 163.
atrofaciens, wheat, 215.
campestre, brussels sprouts, 109.
cabbage, 104.
cauliflower, 109.
rutabaga, 111.
cerasi, cherry, 354.
citri, citrus, 377.
citriputeale, citrus, 381.
coronafaciens, Avena fatua, 230.
oats, 230.
delphinii, larkspur, 440.
dissolvens, corn, 166, 168, 238.
erodii, geranium, 436.
exitiosum, (see B. vesicatorium), 160.
flaccumfaciens, bean, 3, 97.
soybean, 256.
glycineum, soybean, 256.
juglandis, walnut, 391.
lachrymans, cucumber, 117.
maculicolum, cauliflower, 109.
malvacearum, cotton, 125, 481.
marginale, lettuce, 152.
medicaginis, alfalfa, 248.
phaseoli, bean, 89, 479, 480.
lima bean, 97.
phaseoli sojense, soybean, 256.
pruni, apricot, 356.
peach, 340.
plum, 349.
solanacearum, cosmos, 436.
dahlia, 435.
peanut, 159.
pepper, 160.
potato, 46.
soybean, 167, 256.
tobacco, 142.
tomato, 64, 478.
sp., velvet bean, 258.
tabacum, tobacco, 135.
translucens, rye, 219.
translucens undulosum, wheat, 208.
tumefaciens, almond, 391.
apple, 308.
apricot, 356.
blackberry, 372.
cherry, 354.
grape, 361.
peach, 344.
pear, 328.
pecan, 390.
plum, 350.
raspberry, 368.
sugar beet, 134.
wild rose, 446.
willow, 431.
turnip, 111.
vesicatorium, pepper, 160.
tomato, 2, 66.
vignae, cowpea, 166, 256.
viridilividum, lettuce, 152.
vitians, lettuce, 152.
Balm of Gilead poplar, canker, 426.
(see poplar), 426.

Baldwin spot, (see bitter pit), 311.
Banana, literature, 388.
Barberry, eradication, 190.
leaf spot, 433.
Bark cankers, apple, 314.
Barley, anthracnose, 224.
black spotting of leaves, 224.
covered smut, 219, 467, 468.
crop losses, 462, 467, 468.
ergot, 224.
leaf blotch, 224.
leaf rust, 221, 467, 468.
loose smut, 220, 467, 468.
net blotch, 222.
powdery mildew, 224.
Puccinia simplex, 167.
Rhynchosporium secalis, 167.
root rots, 223.
rusty spot, 224.
scab, 223.
scald, 223.
spot blotch, 223.
stem rust, 220, 467, 468.
stripe, 222, 467, 468.
stripe rust, 166, 196, 221.
Basal glume rot, wheat, 215.
Basisporium gallarum, tomato, 3, 67.
Basswood, anthracnose, 410.
Phyllosticta tiliae, 410.
Bastard blossom, periwinkle, 443.
Bean, angular leaf spot, 96.
anthracnose, 4, 91, 479, 480.
bacterial blight, 4, 89, 479, 480.
Bacterium flaccumfaciens, 3, 97.
chlorosis, 96.
crop losses, 462, 479, 480.
hopperburn, 96.
leaf spot, 96.
mosaic, 4, 94, 479, 480.
pod rot, 96.
pod spot, 96.
powdery mildew, 95.
Rhizoctonia stem rot, 96.
root knot, 96.
root rot, 2, 4, 479, 480.
Fusarium, 2, 95.
Ozonium, 96.
Rhizoctonia, 2.
Texas, 96.
Thielavia, 2.
rust, 93.
southern blight, 96.
Texas root rot, 96.
vine rot, 96.
wilt, Sclerotium, 96.
Beet, leaf spot, 145.
root disease, 145.
root knot, 145.
scab, 144.
wilt, 145.
Begonia, nematodes, 434.
sp., (see begonia), 434.
Bent grass, brown patch, 260.
Berberis sp., (see barberry), 433.
Betula fontinalis, (see western red birch), 410.
lenta, (see sweet birch), 410.
papyrifera, (see paper birch), 411.
populifolia, (see white birch), 411.
spp., (see birch), 411.
Birch, leaf spot, 411.
Birch, paper, powdery sapwood rot, 411.
white wood, 411.
wood rot, 411.
Birch, sweet, canker, 411.
Birch, western red, leaf spot, 410.
powdery mildew, 411.
Birch, white, Melanconium betulinum, 411.
Septoria betulina, 411.
Bitter pit, apple, 311, 319, 320.
pear, 328.
Bitter rot, apple, 288, 319, 320, 482.
cranberry, 375.
Blackberry, anthracnose, 372.
blue stem, 373.
crown gall, 372.
double blossom, 373.
leaf spot, Cercospora, 373.
Mycosphaerella, 372.
mosaic, 373.
rusts, 372, 373.
winter injury, 373.
Black chaff, wheat, 208.
Black currant, white pine blister rust, 405.
Black dot, potato, 46.
Black end, pear, 328.
Blackened cob, corn, 240.
Blackfire, tobacco, 137.
Black heart, celery, 148.
potato, 50.
sweet potato, 88.
Black knot, black cherry, 413.
cherry, 354.
plum, 350.

western choke cherry, 413.
Black leaf, pear, 326.
Blackleg, brussels sprouts, 109.
cabbage, 5, 106.
cauliflower, 110.
potato, 3, 28, 473, 474.
Black mold, cabbage, 107.
corn, 240;
onion, 100.
Black mold rot, peach, 342.
Black pit, pecan, 390.
Black point, wheat, 214.
Black root, radish, 111.
Black root rot, sweet pea, 450.
tobacco, 138.
violet, 450.
Black rot, apple, 291, 319, 320, 482.
brussels sprouts, 109.
cabbage, 5, 104.
carrot, 145.
cauliflower, 109.
grape, 357, 490.
pear, 328.
quince, 330.
rutabaga, 111.
sweet potato, 82, 83, 477.
Black smut, fig, 385.
Black specked leaf spot, maple, 423.
Black spot, avocado, 386.
Black spotting of leaves, barley, 224.
Blast, citrus, 381.
oats, 230.
rice, 240.
Blazing star, (see Liatris graminifolia), 457.
Blight, Alternaria, golden seal, 454.
Ascochyta, cotton, 128.
pea, 156.
bacterial, alfalfa, 248.
bean, 4, 89, 479, 480.
larkspur, 440.
lima bean, 97.
loquat, 388.
pea. 158.
pear, 322.
raspberry, 371.
rye, 219.
sorghum, 245.
soybean, 256.
Sudan grass, 260.
tomato, 64.
walnut, 391.
Botrytis, golden seal, 454.
peony, 442.
Cercospora, mulberry, 375.
chestnut, 413.
citrus, 383.
Coryneum, apricot, 356.
peach, 342.
cranberry, 375.
Fusarium, spinach, 162.
Helminthosporium, wheat, 206.
Lophodermium, pine, 407.
Mycosphaerella, pea, 156.
Phomopsis, eggplant, 150.
Sclerotium, tomato, 65.
Septoria, tomato, 478.
Blister canker, apple, 290, 319.
Bloom drop, mango, 387.
Blossom blight, mango, 387.
pear, 329.
Blossom drop, tomato, 67.
Blossom end disease, watermelon, 3.
Blossom end rot, citrus, 382.
tomato, 62.
watermelon, 121.
Blotch, apple, 283, 319, 320, 482.
Blueberry, (see Vaccinium sp.), 461.
Blue grass, brown patch, 260.
Blue mold rot, apple, 313.
citrus, 381.
grape, 360.
plum, 350.
raspberry, 371.
Blue stem, blackberry, 373.
raspberry, 371.
Boll rots, cotton, 128.
Borage, Rio Grande disease, 451.
Botryosphaeria dothidea, wild rose, 446.
ribis, currant, 373.
sp., black gum, 417.
Botrytis allii, onion, 100.
apple, 314.
artichoke, 143.
cinerea, lettuce, 152.
(see Sclerotinia fuckeliana), 444.
plum, 350.
sp., geranium, 437.
golden seal, 454.
raspberry, 371.
strawberry, 365.
wild rose, 446.
spp., peony, 442.
vulgaris, sweet potato, 87.

Bottom rot, lettuce, 4, 152.
Box elder, leaf spot, 421.
Septomyxa negundinis, 421.
Box, Macrophoma candollei, 434.
Volutella buxi, 434.
Bremia lactucae, lettuce, 153.
Broad leaf spot, tobacco, 142.
Broken straw, wheat, 214.
Brome grass, (see Bromus inermis), 264.
Bromus adoensis, Puccinia glumarum, 263.
erectus, Puccinia glumarum, 263.
inermis, Helminthosporium bromi, 261.
Helminthosporium giganteum, 261.
Septoria bromi, 167.
sp., 264.
lanuginosus, Puccinia glumarum, 263.
macrostachys, Puccinia glumarum, 263.
maximus, Puccinia glumarum, 263.
porteri frondosus, Puccinia glumarum, 263.
purgans latiglumis, Puccinia glumarum, 263.
richardsonii, Puccinia glumarum, 263.
rigidus, Puccinia glumarum, 263.
secalinus, Ophiobolus cariceti, 262.
sp., Puccinia graminis, 263.
spp., Puccinia clematidis, 262.
smut, 263.
Brown leaf spot, pecan, 390.
Brown patch, bent grass, 260.
blue grass, 260.
fescue grass, 260.
red top, 260.
Brown rot, apple, 314.
apricot, 355.
cherry, 353, 489.
choke cherry, 413.
peach, 330, 484, 485.
plum, 346, 488.
Brown rot gummosis, citrus, 382.
Brown spot, corn, 237, 471.
tobacco, 143.
Brown trunk rot, western larch, 398.
Brussels sprouts, blackleg, 109.
black rot, 109.
Buckeye, California, leaf spot, 411.
Buckeye, leaf blotch, 411.
Buckeye rot, tomato, 66.
Buckthorn, crown rust, 411.
Bud rot, peony, 442, 443.
Bunched red roots, celery, 149.
Bunt, rye, 219.
wheat, 166, 169, 463, 464.
Bur clover, leaf spot, 255.
Bursa bursa-pastoris, white rust, 451.
Butternut, melanconis, 412.
Buttonweed, (see Diodia teres), 453.
Butt rot, scarlet oak, 424.
silver fir, 394.
western hemlock, 397.
white elm, 416.
Buxus sempervirens, (see box), 434.

C

Cabbage, Alternaria, 5.
blackleg, 5, 106.
black mold, 107.
black rot, 5, 104.
club root, 100.
downy mildew, 108.
drop, 109.
dying, 109.
head rot, 109.
lack of heading, 109.
leaf spot, 107.
Rhizoctonia solani, 109.
ring spot, 108.
root knot, 109.
root rot, 109.
slimy soft rot, 108.
soft rot, 109.
stem rot, 109.
yellowing, 109.
yellows, 4, 102.
Cactus, charcoal spot, 451.
damping off, 451.
Caeoma abietis-canadensis, (see Melampsora abietis-canadensis), 397.
Calamagrostis americana, Claviceps purpurea, 261.
Calico, potato, 4, 41, 42.
Calla lily, soft rot, 434.
Callistephus chinensis, (see China aster), 433.
Calyptospora goeppertiana, Vaccinium sp., 461.
Camarosporium eleagnellum, Eleagnus angustifolia, 415.
Camellia japonica, (see camellia), 434.
leaf spot, 434.

Camphor, anthracnose, 412.
canker, 412.
leaf spot, 412.
Pestalozzia sp., 412.
Cane blight, currant, 373.
raspberry, 368, 371.
wild rose, 446.
Canker, apple, 314, 315.
bark, apple, 314.
Botryosphaeria, wild rose, 446.
citrus, 377.
Creonectria, sweet birch, 411.
Cytospora, apple, 314.
Balm of Gilead poplar, 426.
black cottonwood poplar, 427.
Carolina poplar, 426.
elder, 415.
mountain ash, 410.
poplar, 427.
quaking aspen poplar, 427.
red alder, 409.
western choke cherry, 413.
willow, 431.
Diplodia, camphor, 412.
fig, 386.
European, apple, 306.
poplar, 428.
fig, 386.
Fusarium, Humulus lupulus, 456.
Fusicoccum, apple, 314.
chestnut, 414.
Leptosphaeria, apple, 315.
wild rose, 446.
Lombardy poplar, 426.
Macrophoma, fig, 386.
miscellaneous bark, apple, 314.
Myxosporium, apple, 314.
Nectria, apple, 306.
pear, 328.
walnut, 391.
physiological, pear, 328.
pox, apple, 315.
Rosellinia, hickory, 419.
Septobasidium, apple, 315.
pear, 328.
sequoia, 408.
Sphaeropsis, elm, 417.
white elm, 416.
Tubercularia, fig, 386.
sycamore, 430.
walnut, 391.
Cantaloupe, Alternaria, 6.
anthracnose, 112.
bacterial wilt, 112, 114.
downy mildew, 113.
fruit spot, 114.
hail injury, 114.
leaf blight, 112.
leaf mold, 112.
leaf spot, 114.
mosaic, 113.
root knot, 114.
southern blight, 114.
spray injury, 114.
wilt, 114.
Capriola dactylon, Helminthosporium giganteum, 261.
Puccinia cynodontis, 262.
Carnation, alternariose, 434.
chlorosis, 435.
root knot, 434.
rust, 434.
stem rot, 434.
white tip, 435.
wilt, 434.
Carrot, Bacillus carotovorus, 5.
black rot, 145.
leaf blight, 145.
leaf spot, 145.
nematode, 145.
Rio Grande disease, 3, 145.
soft rot, 145.
watery soft rot, 145.
Cascara, leaf rust, 412.
leaf spot, 412.
Castanea dentata, (see chestnut), 413.
Castilleja angustifolia, (see Indian paint brush), 456.
Catalpa bignonioides, (see catalpa), 412.
catalpa, (see catalpa), 412.
leaf spot, 412, 413.
Phyllosticta catalpae, 412.
powdery mildew, 413.
sp., (see catalpa), 412.
Catface, tomato, 67.
Catkin deformation, mountain alder, 409.
Cauliflower, blackleg, 110.
black rot, 109.
club root, 110.
peppery spot, 109.
ring spot, 110.
stem rot, 110.
Ceanothus velutinus, Cylindrosporium ceanothi, 452.

Cedar leaf blight, giant arborvitae, 394.
Cedar rust, apple, 482.
(see also rust), 294.
Cedar, white, rust, 394.
Cedar, yellow, rust, 394.
Celery, bacterial leaf spot, 148.
black heart, 148.
bunched red roots, 149.
damping off, 149.
dusting, 6.
early blight, 147.
frost injury, 149.
heart rot, 148.
late blight, 4, 146.
mosaic, 2, 149.
root knot, 149.
root rot, 149.
slime mold, 149.
soft rot, 148.
stem browning, 149.
watery soft rot, 148.
yellows, 2, 4, 147.
Celtis occidentalis, (see hackberry), 417.
Centaurea cyanus, (see bachelor's button), 433.
Cephaleuros virescens, camphor, 412.
Cephalosporium, apple, 314.
Cephalothecium roseum, apple, 313.
Cercospora althaeina, hollyhock, 439.
angulata, currant, 373.
apii carotae, carrot, 145.
apii, celery, 147.
parsley, 155.
armoraciae, horseradish, 110.
asparagi, asparagus, 144.
beticola, beet, 145.
sugar beet, 132.
swiss chard, 163.
bliti, blackberry, 373.
bolleana, fig, 385.
circumscissa, peach, 344.
citrullina, watermelon, 123.
coffeicola, coffee, 452.
concors, potato, 46.
cruenta, bean, 96.
cowpea, 167, 256.
cucurbitae, cantaloupe, 114.
flagelliformis, spinach, 162.
fusca, pecan, 390.
gossypina, cotton, 128.
lippiae, Lippia lanceolata, 457.
mali, apple, 314.
medicaginis, alfalfa, 249.
moricola, (see C. sp.), 375.
nicotianae, tobacco, 142.
personata, peanut, 159.
rhubarb, 2.
sp., clover, 255.
mulberry, 375.
mustard, 111.
pepper, 160.
rhubarb, 160.
velvet bean, 258.
stizolobii, Stizolobium pruriens, 258.
Stizolobium spp., 258.
velvet bean, 258.
vaginae, sugar cane, 131.
Cercosporella pastinaceae, parsley, 155.
persicae, peach, 344.
sp., turnip, 111.
Cereal diseases, 164.
Cereals, diseases for observation, 16
mosaic diseases, 168.
new diseases, 166.
new hosts, 166, 167.
new locations, 167.
new occurrences, 166.
relative prevalence in 1922, 166.
stem rust, 166.
Certification, sweet potato, 6, 69.
Chaemacyparis nootkatensis, (see yellow cedar), 394.
thyoides, (see white cedar), 394.
Chaenomeles japonica, (see Japanese flowering quince), 444.
Chaetochloa italica, Sclerospora graminicola, 264.
lutescens, Ustilago neglecta, 264.
viridis, Sclerospora graminicola, 264.
Charcoal rot, sweet potato, 87.
Charcoal spot, cactus, 451.
Chemical injury, white pine, 404.
Cherry, bacterial gummosis, 354.
black knot, 354.
brown rot, 353, 489.
crop losses, 489.
crown gall, 354.
frost injury, 355.
fruit rot, 355.
imperfect pollination, 355.
leaf spot, 351, 489.

powdery mildew, 354.
root trouble, 355.
scab, 354.
spray injury, 355.
winter injury, 355.
Cherry, black, black knot, 413.
leaf spot, 413.
Polyporus sulphureus, 413.
powdery mildew, 413.
Cherry, choke, anthracnose, 413.
brown rot, 413.
powdery mildew, 413.
rust, 413.
Volutella nectrioides, 413.
Cherry, western choke, black knot, 413.
canker, 413.
leaf blisters, 413.
leaf injury, 413.
sclerotiniose, 413.
Chestnut, blight, 413.
canker, 414.
leaf spot, 415.
Nummularia sp., 415.
powdery mildew, 415.
Chicory, root knot, 149.
Chinese cabbage, Aphelenchus olesistus, 3.
leaf nematode, 110.
new leaf disease, 110.
Chlorosis, bean, 96.
carnation, 435.
currant, 373.
maple, 423.
peach, 345.
peanut, 160.
plum, 351.
soybean, 257.
sweet potato, 89.
wild rose, 447.
Chocolate spot, horse bean, 259.
Chrysanthemum hortorum, (see chrysanthemum), 435.
leaf spot, 435.
powdery mildew, 435.
Chrysomyxa weirii, Engelmann spruce, 408.
Cinnamomum camphora, (see camphor), 412.
Citron, anthracnose, 114.
Citrus, anthracnose, 381.
blast, 381.
blight, 383.
blossom end rot, 382.
blue mold rot, 381.
brown rot gummosis, 382.
canker, 377.
damping off, 383.
die-back, 383.
foot rot, 382.
frost injury, 376.
fruit rot, 381.
gummosis, 382.
lime withertip, 383.
melanose, 379.
mottle leaf, 383.
nailhead rust, 382.
oil burn, 383.
psorosis, 382.
scab, 378.
scaly bark, 382.
Septobasidium pedicellatum, 383.
sooty mold, 383.
spray injury, 383.
star melanose, 383.
stem end rot, 380.
sulphur sunburn, 383.
wither tip, 381.
Cladosporium carpophilum, apricot, 356.
cherry, 354.
peach, 338, 484, 485.
plum, 350.
cucumerinum, cantaloupe, 114.
cucumber, 118.
fulvum, tomato, 64.
herbarum citricolum, citrus, 382.
paeoniae, peony, 443.
sp., corn, 240.
snapdragon, 449.
viticolum, grape, 361.
Clasterosporium caricinum, Scirpus occidentalis, 459.
laciniariae, Liatris graminifolia, 457.
Calviceps purpurea, Agropyron repens, 261.
Agropyron smithii, 261.
barley, 224.
Calamagrostis americana, 261.
Elymus macounii, 261.
rye, 218, 465, 466.
Spartina pectinata, 261.
wheat, 212.
Clematis, rust, 436.
virginiana, (see clematis), 436.
Clitocybe sp., peach, 344.
spp., grape, 361.
Cloud, apple, 319, 320.

Clover, anthracnose, 254.
dodder, 255.
leaf spot, Macrosporium, 255.
Pseudopeziza, 254.
Sphaerulina, 254.
mold, 255.
mosaic, 255.
nematode, 168, 254.
powdery mildew, 168, 250.
root rots, 253.
Fusarium, 253.
Sclerotinia, 253.
rusts, 253.
sooty spot, 255.
spot, 255.
Club root, cabbage, 100.
cauliflower, 110.
Coccomyces hiemalis, cherry, 351, 489.
lutescens, black cherry, 413.
prunophorae, choke cherry, 413.
plum, 349.
Coconut, literature, 392.
Coffea spp., (see coffee), 452.
Coffee, leaf spot, 452.
Coffee tree, Kentucky, Coniothyrium olivaceum gymnocladi, 415.
Coleosporium delicatulum, Arizona long-leaf pine, 400.
Corsican pine, 401.
Euthamia spp., 453.
loblolly pine, 407.
longleaf pine, 401.
pitch pine, 403.
pond pine, 403.
red pine, 403.
shortleaf pine, 400.
slash or swamp pine, 399.
helianthi, Helianthus spp., 455.
jack pine, 400.
scrub pine, 407.
shortleaf pine, 400.
inconspicuum, coreopsis, 452.
longleaf pine, 401.
shortleaf pine, 400.
narcissi, monarda, 441.
solidaginis, Aster sp., 451.
China aster, 433.
sp., Verbesina spp., 461.
terebinthinaceae, loblolly pine, 407.
longleaf pine, 401.
Parthenium integrifolium, 458.
pitch pine, 403.
pond pine, 403.
shortleaf pine, 400.
Silphium spp., 460.
vernoniae, shortleaf pine, 400.
Collaborators, list of, Supl 29.
Collar blight, tomato, 65.
Collar rot, apple, 304.
Colletotrichum antirrhini, snapdragon, 448.
atramentarium, potato, 46.
cereale, barley, 224.
oats, 230.
rye, 217.
Sudan grass, 260.
wheat, 209.
circinans, onion, 99.
falcatum, sugar cane, 130.
gloeosporioides, avocado, 386.
citrus, 381.
mango, 387.
gossypii, cotton, 481.
graminicolum, corn, 240.
kentiae, Kentia balmoreana, 439.
lagenarium, cantaloupe, 112.
citron, 114.
cucumber, 117.
watermelon, 120.
lindemuthianum, bean, 91, 479, 480.
lima bean, 97.
phomoides, tomato, 66.
pisi, pea, 159.
sp., cotton, 128.
pine, 407.
sorghum, 246.
spinaceae, spinach, 162.
trifolii, alfalfa, 248.
clover, 254.
sweet clover, 255.
Collybia velutipes, horsechestnut, 420.
Common scab, potato, 24.
Cone rust, hemlock, 397.
Conifers, diseases, 394.
Coniothyrium fuckelii, (see Leptosphaeria coniothyrium), 315, 446.
hellebori, hellebore, 438.
olivaceum gymnocladi, Kentucky coffee tree, 415.
Control measures, progress, 5.
mosaic, 5.
potato late blight, 10.
Copper injury, apple, 316.
Coral spot, horsechestnut, 420.

Coreopsis, rust, 452.
spp., (see coreopsis), 452.
Cork spot, plum, 351.
Corn, anthracnose, 240.
bacterial stalk rot, 166, 168, 238.
bacterial wilt, 237.
Bacterium dissolvens, 166.
blackened cob, 240.
black mold, 240.
brown spot, 237, 471.
crop losses, 462, 471, 472.
Diplodia seedling blight, 166.
dry rot, 236.
ear mold, 236.
ear rots, 236, 472.
head smut, 168, 233.
Helminthosporium leaf blight, 166.
Helminthosporium sp., 239.
leaf blight, 239.
leaf rust, 472.
leaf spots, 240.
mosaic, 168, 238.
purple sheath spot, 240.
root rots, 233.
Fusarium, 233, 471, 472.
Gibberella, 233.
rust, 233.
smut, 166, 231, 471.
stalk rots, 233.
bacterial, 168, 238.
Fusarium, 233.
Gibberella, 233.
yellow speck, 240.
Cornus nuttallii, (see dogwood), 415.
Corroded roots, ginseng, 151.
Corrugated mosaic, potato, 41.
Coriscan pine, rust, 401.
Corticium laetum, fig, 386.
stevensii, pear, 328.
tomato, 2.
vagum, bean, 96.
potato, 19.
sugar beet, 134.
tomato, 59.
vagum solani, strawberry, 366.
Corylus californica, (see California hazelnut), 418.
Coryneum beijerinckii, apricot, 356.
peach, 342.
juniperinum, giant arborvitae, 394.
Cosmos sp., (see cosmos), 436.
wilt, 436.
Cotoneaster horizontalis, (see cotoneaster), 435.
Cotoneaster, Phyllosticta horizontalis, 435.
Cotton, angular leaf spot, 125, 481.
anthracnose, 123, 481.
Ascochyta blight, 128.
boll rots, 128.
crop losses, 462, 481.
Fusarium wilt, 124, 481.
leaf spot, Alternaria, 128.
Cercospora, 128.
potash hunger, 129.
root knot, 128, 481.
root rot, 126.
rust, 128.
sooty mold, 129.
sore shin, 128.
sunburn, 129.
Texas root rot, 126.
wilt, Fusarium, 124, 481.
Covered kernel smut, sorghum, 245.
Covered smut, barley, 219, 467, 468.
oats, 469, 470.
Cowpea, Alternaria atrans, 166, 256.
aphid injury, 256.
bacterial spot, 256.
Bacterium vignae, 166, 256.
Cercospora cruenta, 167.
leaf spot, Amerosporium, 256.
Cercospora, 256.
mosaic, 168, 256.
powdery mildew, 256.
root rot, 256.
rust, 256.
sunburn, 256.
wilt, Fusarium, 256.
Cranberry, bitter rot, 375.
blight, 375.
early rot, 375.
end rot, 375.
false blossom, 375.
fruit rots, 374.
Fusicoccum putrefaciens, 374, 375.
Glomerella rufomaculans vaccinii, 374.
hard rot, 375.
leaf smudge, 375.
Phomopsis, 375.
red leaf spot, 375.
rosebloom, 374, 375.
Sclerotinia oxycocci, 375.
Sporonema oxycocci, 375.

storage rot, 375.
Crataegus chrysocarpus, (see hawthorn), 418.
douglasi, (see hawthorn), 418.
oxyacantha, (see hawthorn), 418.
spp., (see hawthorn), 418.
Creonectria coccinea, sweet birch, 411.
Cress, stem rot, 110.
Crimson clover, (see clover), 253.
Crinkled joint, wheat, 215.
Crinkle, potato, 4, 41.
Cronartium cerebrum, jack pine, 400.
scrub pine, 407.
comptoniae, lodgepole pine, 399.
filamentosum, lodgepole pine, 399.
harknessii, Indian paint brush, 456.
lodgepole pine, 399.
western yellow pine, 402.
helianthi, jack pine, 400.
pyriforme, western yellow pine, 402.
ribicola, black currant, 405.
Ribes cynosbati, 405.
nigrum, 405.
rotundifolium, 405.
spp., 459.
western white pine, 401.
white pine, 404.
strobilinum, pine, 408.
Crop losses, 462.
apple, 462, 482, 483.
barley, 462, 467, 468.
bean, 462, 479, 480.
cherry, 489.
corn, 462, 471, 472.
cotton, 462, 481.
grape, 490.
oats, 462, 469, 470.
peach, 462, 484, 485.
pear, 486, 487.
plum, 488.
potato, 462, 473, 474, 475, 476.
raspberry, 490.
rye, 462, 465, 466.
sweet potato, 462, 477.
tomato, 478.
wheat, 462, 463, 464.
Crown gall, almond, 391.
apple, 308.
apricot, 256.
blackberry, 372.
cherry, 354.
grape, 361.
peach, 344.
pear, 328.
pecan, 390.
plum, 350.
raspberry, 368.
sugar beet, 134.
wild rose, 446.
willow, 431.
Crown rot, rhubarb, 160.
spinach, 163.
sugar beet, 134.
Crown rust, buckthorn, 411.
oats, 227, 469, 470.
Rhamnus cathartica, 229.
Crown wart, alfalfa, 248.
Crucifers, diseases of, 100.
Cryptantha intermedia, Synchytrium myosotidis, 452.
Cryptosporella viticola, grape, 361.
Cryptosporium pini, white pine, 404.
Cryptostictis sp., rhododendron, 444.
Cucumber, angular leaf spot, 117.
anthracnose, 117.
damping off, 119.
downy mildew, 118.
leaf spot, Alternaria, 118.
Macrosporium, 119.
mosaic, 116.
powdery mildew, 119.
root knot, 119.
scab, 118.
slime mould, 119.
stem rot, 119.
white tips, 119.
wilt, bacterial, 114.
Fusarium, 119.
Cucurbits, diseases of, 112.
Curly dwarf, potato, 4, 41, 48.
(see mosaic), 48.
Curly top, sugar beet, 133.
swiss chard, 163.
Currant, anthracnose, 373.
cane blight, 373.
chlorosis, 373.
leaf spot, Cercospora, 373.
Mycosphaerella, 373.
Septoria, 373.
root rot, 373.
Cuscuta sp., clover, 255.
sunflower, 259.
spp., alfalfa, 249.
Cylindrosporium californicum, Oregon ash, 410.
ceanothi, Ceanothus velutinus, 452.

padi, apricot, 356.
(see Cocoomyces prunophorae), 413.
sp., dwarf maple, 420.
hawthorn, 418.
spiraeicolum, Spiraea douglasii, 460.
Cynodon dactylon, (see Capriola dactylon), 261.
Cystospora batata, sweet potato, 5, 86, 477.
Cytospora canker, apple, 315.
chrysosperma, Balm of Gilead poplar, 426.
black cottonwood poplar, 427.
Carolina poplar, 426.
elder, 415.
mountain ash, 410.
poplar, 427.
quaking aspen poplar, 427.
western choke cherry, 413.
willow, 431.
sp., apple, 315.
red alder, 409.

D

Dactylis glomerata, Erysiphe graminis, 261.
Puccinia graminis, 263.
Uromyces dactylidis, 167, 264.
Daedalea berkeleyi, pine, 407.
Dahlia, mosaic, 435.
powdery mildew, 435.
root knot, 435.
root rot, 435.
sp., (see dahlia), 435.
wilt, 435.
yellows, 435.
Damping off, cactus, 451.
celery, 149.
citrus, 383.
cucumber, 119.
eggplant, 150.
lettuce, 154.
mangel, 155.
pea, 159.
radish, 111.
red pine, 403.
scotch pine, 407.
spinach, 162.
sugar beet, 134.
tobacco, 143.
tomato, 65.
white pine, 404.
Dartrose, (see black dot), 46.
Date, leaf spot, 386.
Datura stramonium, leaf blight, 452.
tatula, leaf blight, 453.
Dead arm, grape, 361.
Decay of stalk, sorghum, 246.
Decaying seed pieces, potato, 45.
Decay, watermelon, 122.
Degeneration diseases, potato, 40.
Delphinium sp., (see larkspur), 440.
Dendrophoma obscurans, strawberry, 366.
Dewberry, (see blackberry), 373.
Dianthus caryophyllus, (see carnation), 434.
Diaporthe batatatis, sweet potato, 87.
juglandis, (see Melanconis juglandis), 412.
phaseolorum, lima bean, 97.
Didymella chamaecyparissi, Lycopodium complanatum flabelliforme, 457.
sp., camellia, 434.
Didymellina iridia, iris, 439.
Die-back, citrus, 383.
mango, 387.
peach, 344.
Digitalis purpurea, new abnormality, 435.
Digitaria sanguinalis, (see Syntherisma sanguinalis), 262.
Dimerium sp., western hemlock, 397.
Dimerosporium collinsii, western service berry, 429.
Diodia teres, rust, 453.
Diplocarpon rosae, (see Actinonema rosae), 445.
Diplodia, corn, 166.
gossypina, cotton, 128.
natalensis, citrus, 380.
mango, 387.
sp., camphor, 412.
citrus, 382.
watermelon, 121.
suberina, chestnut oak, 425.
sycina syncophila, fig, 386.
taxi, western yew, 408.
tubericola, sweet potato, 87.
zeae, corn, 236.
Disease caused by Septoria spp., wheat, 209.
Disease, fruit or blossom, tomato, 66.

Diseases of stem, tomato, 65.
Diseases for observation, cereals, 167.
Diseases of pome fruits, 273.
Diseases of stone fruits, 330.
Distichlis spicata, Puccinia subnitens, 263.
Dock, leaf spot, 453.
Dodder, alfalfa, 249.
clover, 255.
sunflower, 259.
Dogwood, European canker, 415.
powdery mildew, 415.
Dothichiza, apple, 314.
populea, poplar, 428.
Dothidella ulmea, (see Gnomonia ulmea), 415.
Dothiorella pinastri, scotch pine, 407.
Double blossom, blackberry, 373.
Douglas fir blight, balsam fir, 395.
Douglas fir, 396.
hemlock, 396, 397.
Japanese larch, 396, 399.
western hemlock, 397.
western larch, 399.
Douglas fir mistletoe, Douglas fir, 396.
Downy mildew, alfalfa, 248.
cabbage, 108.
cantaloupe, 113.
cucumber, 118.
grape, 358.
Humulus lupulus, 356.
lettuce, 3, 153.
lima bean, 96.
onion, 99.
pea, 159.
pumpkin, 119.
radish, 111.
soybean, 256.
spinach, 161.
squash, 119.
sunflower, 259.
watermelon, 123.
Drop, cabbage, 109.
lettuce, 151.
Dropsy, geranium, 438.
Drought injury, apple, 315.
potato, 51.
sycamore, 430.
watermelon, 123.
Drought spot, apple, 315.
Dry rot, apple, 314.
corn, 236.
gladiolus, 438.
sweet potato, 87.
white pine, 403.
Dry rot canker, sugar beet, 134.
Duchesnea indica, Peronospora potentillae, 453.
Dusting, 6.
celery, 6.
versus spraying, apple, 318.
Dwarfing, lettuce, 152, 154.
Dying, cabbage, 109.
Dying of needles, pitch pine, 403.

E

Earlea speciosa, wild rose, 446.
spp., wild rose, 446.
Early blight, celery, 147.
potato, 11, 475, 476.
tomato, 59, 478.
Early meadow rue, (see Thalictrum dioicum), 461.
Early rot, cranberry, 375.
Ear mold, corn, 236.
Ear rot, corn, 235, 472.
Eastern blue stem, raspberry, 369.
Echinodontium tinctorium, Engelmann spruce, 408.
lowland fir, 395.
western hemlock, 397.
Ecological observations, 3.
Eggplant, damping off, 150.
blight, 150.
fruit rot, 149.
leaf spot, 149, 150.
mosaic, 150.
Phytophthora terrestris, 150.
undetermined disease, 150.
wilt, 150.
Elaeagnus angustifolia, Camarosporium elaeagnellum, 415.
Elder, canker, 415.
Elder, marsh, Aecidium ivae, 415.
Eleusine indica, Helminthosporium giganteum, 261.
Elfvingia megaloma, white elm, 416.
Elm, anthracnose, 416, 417.
canker, 417.
slime flux, 417.
Texas root rot, 417.
twig blight, 417.
Elm, slippery, anthracnose, 416.

Elm, white, aborted nuts, 416.
anthracnose, 416.
butt rot, 416.
canker, 416.
Macrophoma sp., 416.
powdery mildew, 416.
red heart rot, 416.
twig blight, 416.
wood rot, 416.
Elm, wing, anthracnose, 415.
Elymus canadensis, Erysiphe graminis, 261.
Phyllachora graminis, 262.
Puccinia graminis, 263.
macounii, Claviceps purpurea, 261.
spp., Puccinia clematidis, 262.
virginicus, Helminthosporium giganteum, 261.
Puccinia graminis, 263.
Empoasca mali, bean, 96.
potato, 37.
Endive, heart rot, 150.
watery soft rot, 150.
Endothia parasitica, chestnut, 413.
End rot, cranberry, 375.
Entomosporium thumenii, hawthorn, 418.
Epilobium angustifolium, (see fireweed), 454.
Eradication, barberry, 190.
Eragrostis cilianensis, Helminthosporium giganteum, 261.
pectinacea, Helminthosporium giganteum, 261.
Ergot, barley, 224.
rye, 218, 465, 466.
wheat, 166, 212.
Erigeron annuus, Ophiobolus tenellus, 453.
Erodium moschatum, Synchytrium papillatum, 453.
Erysiphe cichoracearum, chrysanthemum, 435.
cucumber, 119.
dahlia, 435.
golden glow, 438.
phlox, 443.
sunflower, 259.
zinnia, 451.
communis, (see E. polygoni), 461.
graminis, Agropyron repens, 261.
Agropyron tenerum, 261.
Agrostis palustris, 261.
barley, 224.
Dactylis glomerata, 261.
Elymus canadensis, 261.
oats, 231.
Poa pratensis, 261.
rye, 217.
wheat, 214.
polygoni, bean, 95.
cowpea, 256.
cucumber, 119.
lupine, 440.
Lupinus perennis, 457.
matrimony vine, 441.
Oenothera sp., 458.
pea, 156.
radish, 3, 111.
Vicia americana, 461.
sp., clover, 250.
Escarole, mosaic, 151.
watery soft rot, 151.
Euonymus atropurpurea, (see euonymus), 436.
Japanese, powdery mildew, 436.
japonicus, (see Japanese euonymus), 436.
powdery mildew, 436.
spp., anthracnose, 436.
leaf spot, 436.
Euphorbia pulcherrima, (see poinsettia), 443.
spp., Uromyces spp., 453.
European canker, apple, 306.
dogwood, 415.
pear, 328.
poplar, 428.
scarlet oak, 424.
willow, 431.
Euthamia spp., rust, 453.
Exidia glandulosa, mountain maple, 422.
Exoascus amentorum, (see E. tosquinetii), 409.
cerasi, (see Taphrina cerasi), 413.
communis, plum, 348.
deformans, peach, 335, 484, 485.
pruni, plum, 348.
tosquinetii, mountain alder, 409.
Exobasidium oxycocci, cranberry, 374, 375.
vaccinii, cranberry, 375.
kinnikinnick, 456.
manzanita, 457.
rhododendron, 444.

Exosporium concentricum, Euonymus spp., 436.
palmivorum, date, 386.
palm, 442.

F

Fabraea maculata, pear, 327, 486, 487.
quince, 329.
Failure of rye, 219.
False blossom, cranberry, 375.
Flase smut, palm, 442.
Favolus salicis, poplar, 429.
Fern, brake, fir-fern rust, 454.
Fertilizer burning, potato, 52.
Fescue grass, brown patch, 260.
Festuca elatior, Puccinia coronata, 262.
spp., winter injury, 265.
Field crops, diseases, 1, 2.
geographical distribution, 2.
new areas, 2.
Fig, anthracnose, 385.
black smut, 385.
canker, 386.
leaf blight, 385.
leaf spot, 385.
limb blight, 386.
root knot, 386.
rust, 384.
Fir, Alpine, matting, 395.
Fir, balsam, Douglas fir blight, 395.
fir-fern rust, 395.
Fir, Douglas, Douglas fir blight, 396.
Douglas fir mistletoe, 396.
red-brown heartwood butt rot, 395.
red-brown sapwood rot, 395.
red rot, 395.
rot, 396.
Fire blight, apple, 299, 319, 482.
hawthorn, 418.
pear, 486, 487.
Prunus triloba plena, 444.
quince, 329.
service berry, 429.
Fireweed, fir-fireweed rust, 454.
Fir-fern rust, balsam fir, 395.
brake fern, 454.
lowland fir, 395.
Osmunda claytoniana, 395.
silver fir, 394.
Fir-fireweed rust, fireweed, 454.
Fir, lowland, fir-fern rust, 395.
Macrophoma parca, 395.
matting, 395.
needle-cast, 395.
red-brown sapwood rot, 395.
stringy brown rot, 395.
Fir, silver, butt rot, 394.
fir-fern rust, 394.
Fir, Veitch's, Fusicoccum abietinum, 395.
Flag smut, wheat, 167, 180, 181.
Flammula alnicola, red pine, 403.
Flax, heat canker, 244.
new disease, 166, 244.
pasmo, 244.
Rhizoctonia, 244.
rust, 166, 241.
wilt, 166, 243.
Flowering crab, rust, 436.
Fly speck, apple, 309.
plum, 350.
Foliage scalding, pear, 328.
Fomes annosus, silver fir, 394.
western hemlock, 397.
applanatus, maple, 423.
everhartii, paper birch, 411.
fraxinophilus, ash, 410.
igniarius, apple, 315.
Oregon maple, 421.
quaking aspen poplar, 427.
red alder, 409.
willow, 431.
laricis, western yellow pine, 402.
officinalis, western larch, 398.
pinicola, Douglas fir, 395.
lowland fir, 395.
white pine, 403.
ribis, currant, 373.
rimosus, locust, 420.
Foot rot, citrus, 382.
lettuce, 154.
rice, 241.
sweet potato, 85, 88, 477.
wheat, 206, 207.
Forage crops, diseases, 164, 246.
Forest trees, 393.
Formica exsectoides, white pine, 404.
Fraxinus americana, (see white ash), 409.
lanceolata, (see green ash), 409.
oregona, (see Oregon ash), 410.
pennsylvanica, (see red ash), 410.
spp., (see ash), 410.
Freezing injury, potato, 51.
Frenching, tobacco, 143.

Frog-eye, apple, 293.
tobacco, 142.
Frost injury, apple, 273.
apricot, 356.
celery, 149.
cherry, 355.
citrus, 376.
grape, 357.
lemon, 376.
lettuce, 152, 154.
mountain ash, 410.
orange, 376.
pea, 159.
peach, 273, 345.
pear, 273, 329.
plum, 351.
spinach, 163.
squash, 119.
strawberry, 362.
tomato, 65.
Frosty mildew, peach, 344.
Fruit diseases in 1922, 273.
Fruit drop, squash, 119.
Fruit rot, Alternaria, pepper, 160.
cherry, 355.
citrus, 381.
cranberry, 374.
grape, 360.
miscellaneous, apple, 313.
Phomopsis, eggplant, 149.
raspberry, 371
strawberry, 365
Fruit spot, apple, 304.
cantaloupe, 114.
quince, 330.
tomato, 67.
Fuchsia, mosaic, 436.
sp., (see fuchsia), 436.
Fuligo septica, tomato, 65.
sp., strawberry, 367.
violaceae, sweet potato, 89.
Fusarium, apple, 314.
asparagus, 144.
batatatis, sweet potato, 80, 477.
bean, 2.
conglutinans, cabbage, 102.
kale, 110.
conglutinans callistephi, China aster, 433.
corn, 233.
discolor sulphureum, potato, 47.
eumartii, potato, 47.
hyperoxysporum, sweet potato, 80, 477.
lima bean, 97.
lini, flax, 243.
lycopersici, tomato, 3, 55, 478.
malli, onion, 100.
martii phaseoli, bean, 95.
moniliforme, corn, 235, 236.
niveum, watermelon, 122.
oxysporum, potato, 14, 475, 476.
sweet potato, 87.
parasiticum, Humulus lupulus, 456.
pea, 2.
poae, corn, 235.
potato, 47.
radicicola, potato, 48.
rubi, blackberry, 373.
sorghum, 240.
sp., asparagus fern, 432.
barley, 223.
cabbage, 109.
carnation, 434.
celery, 147.
clover, 253.
cotton, 128.
gladiolus, 438.
golden seal, 454.
hickory, 419.
larkspur, 440.
onion, 100.
pea, 157, 159.
snapdragon, 448.
soybean, 257.
spinach, 162.
sweet clover, 255.
tobacco, 142.
tomato, 59.
wheat, 214, 463, 464.
spinach, 3.
spp., bean, 95.
corn, 235, 472.
squash, 119.
strawberry, 365.
tomato, 2.
trichothecioides, potato, 48.
vasinfectum, cotton, 124, 481.
cowpea, 256.
cucumber, 119.
okra, 155.
wheat, 214.
Fusicladium dendriticum eriobotryae, loquat, 388.
effusum, pecan, 389.
sp., western service berry, 429.
Fusicoccum abietinum, Veitch's fir, 395

putrefaciens, cranberry, 374, 375.
pyrorum, apple, 314.
sp., chestnut, 414.
white pine, 404.

G

Gall, black cottonwood poplar, 427.
Ganoderma curtisii, white elm, 416.
Garden beet, (see beet), 144.
Gaylussacia sp., rust, 454.
Geographical distribution, field diseases, 2.
vegetable diseases, 2.
Geranium, bacterial leaf spot, 436.
dropsy, 438.
leaf spot, 437.
Germination diseases, potato, 43.
Giant hills, potato, 3, 4, 41.
Gibberella, corn, 233.
saubinetii, barley, 223.
corn, 235.
oats, 231.
rye, 217.
wheat, 198.
Ginkgo biloba, (see ginkgo), 417.
Irpex tulipiferae, 417.
Ginseng, corroded roots, 151.
Girdle, alfalfa, 249.
Gladiolus, dry rot, 438.
Fusarium rot, 438.
hard rot, 438.
leaf blight, 438.
Sclerotinia dry rot, 438.
sp., (see gladiolus), 438.
Globe artichoke, (see artichoke), 143.
Gloeosporium affine, sassafras, 429.
ampelophagum, grape, 359.
apocryptum, maple, 422, 423.
sugar maple, 422.
camphorae, camphor, 412.
caulivorum, sweet clover, 255.
coryli, California hazelnut, 418.
cylindrospermum, mountain alder, 409.
red alder, 409.
inconspicuum, elm, 417.
limetticolum, citrus, 383.
nervisequum, (see Gnomonia veneta), 429.
nobili, laurel, 440.
potentillae, (see Mollisia earliana), 363.
psidii, guava, 387.
rosae, wild rose, 446.
saccharina, sugar maple, 422.
sp., Euonymus spp., 436.
palm, 442.
sugar maple, 422.
tiliae, basswood, 410.
ulmeum, (see Gnomonia ulmea), 415.
venetum, (see Plectodiscella veneta), 367.
Glomerella cingulata, apple, 288, 482
fig, 385.
horse chestnut, 420.
pecan, 390.
cingulata vaccinii, cranberry, 375.
gossypii, cotton, 123.
rufomaculans vaccinii, cranberry, 374.
Glume blotch, wheat, 210.
Gnomonia canadense, (see G. veneta), 424.
leptostyla, hickory, 419.
walnut, 430.
nervisequum, (see G. veneta), 424.
ulmea, elm, 416.
slippery elm, 416.
white elm, 416.
wing elm, 415.
veneta, oak, 425.
sycamore, 429.
white oak, 424.
Golden glow, powdery mildew, 438.
Golden seal, Alternaria blight, 454.
blight, Botrytis, 454.
Fusarium wilt, 454.
leaf scorch, 455.
mosaic, 455.
root knot, 454.
unknown root rot, 455.
Gooseberry, anthracnose, 374.
leaf spot, 374.
rust, 374.
Grape, anthracnose, 359.
black rot, 357, 490.
blue mold rot, 360.
crop losses, 490.
crown gall, 361.
dead arm, 361.
downy mildew, 358.
frost injury, 357.
fruit rots in transit, 360.
gray mold rot, 360.
leaf spot, 361.
powdery mildew, 359.

Rhizopus rot, 361.
ripe rot, 361.
root rot, Clitocybe, 361.
Ozonium, 361.
rust, 361.
Texas root rot, 361.
Grapefruit, (see Citrus), 376.
Graphiola phoenicis, date, 386.
palm, 442.
Grasses, 260.
miscellaneous, 260.
Puccinia glumarum, 167, 263.
graminis, 263.
Pythium sp., 166.
stripe rust, 166.
Uromyces dactylidis, 167.
Gray mold rot, grape, 360.
lettuce, 152.
plum, 350.
primrose, 444.
raspberry, 371.
strawberry, 365.
Growth cracks, apple, 316.
Guava, anthracnose, 387.
soft rot, 387.
Guignardia aesculi, buckeye, 411.
horsechestnut, 419.
bidwellii, ampelopsis, 432.
grape, 357, 490.
vaccinii, cranberry, 375.
Gum, black, Botryosphaeria sp., 417.
Gummosis, Citrus, 382.
Gum spot, plum, 351.
Gymnocladus dioica, (see Kentucky coffee tree), 415.
Gymnoconia interstitialis, blackberry, 372.
raspberry, 371.
Gymnosporangium botryapites, white cedar, 394.
clavipes, (see G. germinale), 330.
cornutum, mountain ash, 410.
ellisii, white cedar, 394.
germinale, hawthorn, 418.
Japanese flowering quince, 444.
juniper, 398.
quince, 330.
globosum, hawthorn, 418.
harknessianum, western juniper, 397.
western service berry, 429.
juniperi-virginianae, apple, 294, 482.
flowering crab, 436.
hawthorn, 418.
juniper, 398.
juvenescens, western juniper, 397.
kernianum, western juniper, 397.
western service berry, 429.
nelsoni, Rocky Mountain juniper 398.
western service berry, 429.
nootkatensis, yellow cedar, 394.
sp., juniper, 398.
spp., hawthorn, 418.
tubulatum, hawthorn, 418.

H

Hackberry, root rot, 417.
Septobasidium sp., 417.
smothering disease, 417.
witches broom, 417.
Hail injury, cantaloupe, 114.
potato, 51.
watermelon, 123.
Halo blight, Avena fatua, 230.
oats, 230.
Hamamelis virginiana, (see witch-hazel), 431.
Hard flesh spots, plum, 351.
Prunus americana x triflora, 351.
Hard rot, cranberry, 375.
gladiolus, 438.
Hardwoods, 409.
Hawthorn, Cylindrosporium sp., 418.
Entomosporium thumenii, 418.
fire blight, 418.
leaf blotch, 418.
Otthia crataegi, 418.
rusts, 418.
Hazelnut, California, Gloeosporium coryli, 418.
Septoria corylina, 419.
Head rot, cabbage, 109.
Head smut, corn, 168, 233.
rye, 217.
sorghum, 245.
Heart rots, apple, 315.
ash, 410.
celery, 148.
endive, 150.
locust, 420.
pear, 328.
sugar beet, 134.
western yellow pine, 402.
western yew, 408.

Heat canker, flax, 244.
Heat necrosis, potato, 51.
Helianthus spp., rust, 455.
Hellebore, Coniothyrium hellebori, 438.
Helleborus niger, (see hellebore), 438.
Helminthosporium bromi, Bromus inermis, 261.
corn, 166.
giganteum, Agropyron elongatum, 261.
Agropyron intermedium, 261.
Agropyron repens, 261.
Agrostis stolonifera, 261.
Bromus inermis, 261.
Capriola dactylon, 261.
Eleusine indica, 261.
Elymus virginicus, 261.
Eragrostis cilianensis, 261.
Eragrostis pectinacea, 261.
Homalocenchrus virginicus, 261
Lasiagrostis splendens, 261.
Muhlenbergia mexicana, 261.
Muhlenbergia schreberi, 261.
Panicum anceps, 261.
clandestinum, 261.
dichotomiflorum, 261.
gattingeri, 261.
Pennisetum japonicum, 261.
Phalaris arundinacea, 261.
Phleum pratense, 261.
Poa pratensis, 261.
timothy, 260.
gramineum, barley, 222, 467, 468.
ravenelii, Sporobolus berteroanus, 262.
sativum, barley, 223.
rye, 219.
wheat, 206, 214.
sp., corn, 239.
oats, 231.
Poa pratensis, 262.
teres, barley, 222.
turcicum, corn, 239.
wheat, 207, 214.
Helotium sphaerophoides, sequoia, 408.
Hemlock, cone rust, 397.
Douglas fir blight, 396, 397.
leaf rust, 396, 397.
rust, 397.
twig rust, 397.
Hemlock, western, butt rot, 397.
Dimerium sp., 397.
Douglas fir blight, 397.
ring scale rot, 397.
stringy brown rot, 397.
Herpotrichia nigra, Alpine fir, 395.
Engelmann spruce, 408.
lowland fir, 395.
Heterodera radicicola, alfalfa, 249.
almond, 391.
apricot, 356.
bean, 96.
beet, 145.
cabbage, 109.
cantaloupe, 114.
carnation, 434.
celery, 149.
cotton, 128, 481.
cucumber, 119.
dahlia, 435.
golden seal, 454.
lettuce, 154.
okra, 155.
peach, 343.
peony, 443.
potato, 48.
sweet clover, 255.
sweet potato, 88.
swiss chard, 163.
tobacco, 143.
tomato, 64.
velvet bean, 259.
watermelon, 123.
sp., fig, 386.
Heterosporium gracile, (see Didymellina iridia), 439.
phlei, timothy, 260.
Heuchera glabra, Puccinia heucherae, 455.
Hibiscus, rust, 438.
sp., (see hibiscus), 438.
Hickory, anthracnose, 419.
canker, 419.
nut rot, 419.
Phyllosticta sp., 419.
witches broom, 419.
Hicoria spp., (see hickory), 419.
Hieroglyphics, tobacco, 142.
Hippeastrum johnsonii, mosaic, 455.
Holcus sorghum sudanensis, (see Sudan grass), 260.
Hollow heart, potato, 50.
sweet potato, 87.
Hollow stem, tomato, 65.
Hollyhock, Ascochyta sp., 439.
leaf spot, 439.

root rot, 439.
rust, 438.
Holodiscus discolor, (see ocean spray), 441.
Homalocenchrus virginicus, Helminthosporium giganteum, 261.
Hop, (see Humulus lupulus), 456.
(see also Humulus sp.), 456.
Hopper burn, bean, 96.
potato, 37, 475, 476.
Hordeum bulbosum, Puccinia glumarum, 263.
jubatum, Puccinia glumarum, 263.
Puccinia graminis, 263.
stripe rust, 197.
maritimum, Puccinia glumarum, 263.
nodosum, Puccinia glumarum, 263.
stripe rust, 197.
Hormodendron cladosporioides, wheat, 215.
pinophilum, western juniper, 398.
Horse bean, chocolate spot, 259.
streak disease, 259.
Horsechestnut, Collybia velutipes, 420.
coral spot, 420.
Glomerella cingulata, 420.
leaf blotch, 419.
leaf spot, 420.
powdery mildew, 420.
Schizophyllum alneum, 420.
Tubercularia sp., 420.
Horseradish, leaf spot, 110.
mosaic, 110.
root rot, bacterial, 110.
Rhizoctonia, 110.
Thielavia, 110.
white rust, 110.
Huckleberry, (see Gaylussacia sp.), 454.
(see Vaccinium corymbosum), 461.
(see Vaccinium spp.), 461.
Humulus lupulus, canker, 456.
downy mildew, 456.
sp., mildew, 456.
mosaic, 456.
Hydnum coralloides, white pine, 403.
Hydrangea hortensia, (see hydrangea), 439.
leaf spot, 439.
Hydrastis canadensis, (see golden seal), 454.
Hypholoma appendiculatum, apple, 311.
Hypochnus sp., pecan, 390.
Hypoderma brachysporum, white pine, 404.
commune, Oregon maple, 421.
deformans, lodgepole pine, 400.
western yellow pine, 401.
desmazieri, pitch pine, 403.
sp., parry pinion pine, 403.
Hypodermella laricis, western larch, 398.
Hystrix patula, Phyllachora graminis, 262.

I

Impatiens balsamina, rust, 439.
Imperfect pollination, apple, 316.
cherry, 355.
Increase in production, apple, 268, 273.
peach, 268.
pear, 268.
Indexing, potato tuber, 6.
Indian paint brush, western pine gall rust, 456.
Internal browning, plum, 351.
Internal brown spot, potato, 50
Internal leaf rot, lettuce, 152.
Iris, leaf spot, 439.
soft rot, 439.
spp., (see iris), 439.
Irpex tulipiferae, ginkgo, 417.
Isariopsis griseola, bean, 96.
Iva oraria, (see marsh elder), 415.

J

Japanese larch, Douglas fir blight, 396.
Java black rot, sweet potato, 87.
Jelly end rot, potato, 48.
Jimson weed, (see Datura stramonium), 452.
Jonathan spot, apple, 312.
Juglans cinerea, (see butternut), 412.
spp., (see walnut), 430.
Juniper, common, Pestalozzia funerea, 397, 398.
rust, 398.
Juniper, Rocky Mountain, rust, 398.
Juniperus communis hemisphaerica, (see common juniper), 397.
occidentalis, (see western juniper), 397.

scopulorum, (see Rocky Mountain juniper), 398.
sp., (see juniper), 398.
virginiana, (see juniper), 398.
Juniper, western, Hormodendron pinophilum, 398.
rust, 397.

K

Kale, yellows, 110.
Keithia thujina, giant arborvitae, 394.
Kentia balmoreana, Colletotrichum kentiae, 439.
Kinnikinnick, Exobasidium vaccinii, 456.
Kudzu, leaf spot, 440.
Kuehneola albida, (see K. uredinis), 371.
uredinis, blackberry, 373.
raspberry, 371.
Kunkelia nitens, blackberry, 372.

L

Labrador tea, leaf rust, 456.
Lack of heading, cabbage, 109.
Larch, Japanese, Douglas fir blight, 396, 399.
Larch mistletoe, western larch, 399.
Larch, western, brown trunk rot, 398.
Douglas fir blight, 399.
larch mistletoe, 399.
needle cast, 398.
red-brown heartwood butt rot, 399.
ring scale rot, 399.
sulphur heart rot, 399.
Larix leptolepis, (see Japanese larch), 396, 399.
occidentalis, (see western larch), 398.
Larkspur, blight, 440.
wilt, 440.
Lasiagrostis splendens, Helminthosporium giganteum, 261.
Late blight, celery, 4, 146.
potato, 3, 4, 8, 473, 474.
tomato, 66.
Lathyrus odoratus, (see sweet pea), 449.
Laurel, Gloeosporium nobili, 440.
Sphaeropsis sp., 440.
Laurus nobilis, (see laurel), 440.
sp., (see laurel), 440.
Lavender, Pholiota praecox, 440.
Lavendula sp., (see lavender), 440.
Lawn grass, Physarum cinereum, 262.
Leaf blight, Alternaria, cantaloupe, 112.
Datura stramonium, 452.
Datura tatula, 453.
Coccomyces, plum, 349.
Fabraea, pear, 327.
quince, 329.
fig, 385.
gladiolus, 438.
Helminthosporium, corn, 166, 239.
Macrosporium, carrot, 145.
madrona, 420.
mangel, 155.
Oregon ash, 410.
palm, 442.
pear, 327, 486, 487.
Leaf blister, oak, 425.
water oak, 425.
western choke cherry, 413.
Leaf blotch, barley, 224.
buckeye, 411.
hawthorn, 418.
horsechestnut, 419.
rose, 445.
rye, 219.
willow, 431.
Leaf cast, white pine, 404.
white spruce, 408.
Leaf chlorosis, oak, 426.
Leaf curl, peach, 335, 484, 485.
raspberry, 369, 490.
Leaf disease, Chinese cabbage, 110.
Leaf drop, potato, 4.
Leaf hoppers, potato, 37.
Leaf injury, western choke cherry, 413.
Leaf mold, cantaloupe, 112.
onion, 99.
tomato, 64.
Leaf nematode, Chinese cabbage, 110.
Leaf roll, potato, 4, 35, 473, 474.
tomato, 65.
Leaf rolling mosaic, potato, 4, 40.
Leaf rust, barley, 221, 467, 468.
black cottonwood poplar, 427.
cascara, 412.
corn, 471.
hemlock, 396, 397.
Labrador tea, 456.
manzanita, 457.
quaking aspen poplar, 427.

rhododendron, 444.
rye, 216, 465, 466.
small grains, 166.
Vaccinium spp., 461.
wheat, 192, 463, 464.
wild rose, 446.
Leaf scorch, golden seal, 455.
maple, 424.
Norway maple, 421.
strawberry, 363.
sugar maple, 422.
Leaf smudge, cranberry, 375.
Leaf spot, Actinonema, poinsettia, 443.
alfalfa, 166.
Alternaria, cabbage, 107.
cotton, 128.
cucumber, 118.
Datura stramonium, 452.
lettuce, 153.
persimmon, 387.
tobacco, 3.
watermelon, 123.
Amerosporium, cowpea, 256.
Ascochyta, alfalfa, 249.
rhubarb, 160.
sweet clover, 255.
ash, 410.
bacterial, barberry, 433.
celery, 148.
geranium, 436.
lettuce, 152.
lima bean, 97.
rye, 219.
soybean, 256.
tobacco, 3.
velvet bean, 258.
black specked, maple, 421, 423.
Botrytis, geranium, 437.
peony, 442.
broad, tobacco, 142.
brown, pecan, 390.
Cephaleuros, camphor, 412.
Cercospora, alfalfa, 249.
apple, 314.
bean, 96.
beet, 145.
blackberry, 373.
cantaloupe, 114.
carrot, 145.
coffee, 452.
cotton, 128.
cowpea, 256.
currant, 373.
fig, 385.
hollyhock, 439.
horseradish, 110.
mustard, 111.
parsley, 155.
peanut, 159.
pecan, 390.
pepper, 160.
rhubarb, 160.
spinach, 162.
Stizolobium pruriens, 258.
sp., 258.
sugar beet, 132.
sugar cane, 131.
swiss chard, 163.
tobacco, 142.
velvet bean, 258.
watermelon, 123.
Cercosporella, parsley, 155.
turnip, 111.
Cladosporium, grape, 361.
peony, 443.
Coccomyces, black cherry, 413.
cherry, 351, 489.
corn, 240.
Cryptostictis, rhododendron, 444.
cucumber, 119.
Dendrophoma, strawberry, 366.
Didymella, camellia, 434.
Didymellina, iris, 439.
Dimerosporium, western service berry, 429.
Exosporium, date, 386.
Euonymus spp., 436.
palm, 442.
Glococporium, maple, 422, 423.
mountain alder, 409.
red alder, 409.
sassafras, 429.
sugar maple, 422.
Gnomonia, walnut, 430.
Graphiola, date, 386.
Guignardia, ampelopsis, 432.
Helminthosporium, oats, 231.
rye, 219.
Heterosporium, timothy, 260.
kudzu, 440.
Macrosporium, alfalfa, 249.
bur clover, 255.
catalpa, 412.
clover, 255.
cucumber, 119.
eggplant, 150.

turnip, 111.
Marssonia, chestnut, 415.
chestnut oak, 425.
wild rose, 446.
miscellaneous, apple, 313.
Mycosphaerella, blackberry, 372.
currant, 373.
pear, 328.
raspberry, 370.
strawberry, 362.
oats, 231.
parsley, 2.
Pestalozzia, camellia, 434.
rhododendron, 445.
Phomopsis, eggplant, 149.
Phyllosticta, box elder, 421.
catalpa, 413.
dwarf maple, 420.
hydrangea, 439.
maple, 423.
persimmon, 387.
poplar, 428.
rhubarb, 160.
sugar maple, 422.
sweet potato, 88.
tobacco, 143.
violet, 450.
witch-hazel, 431.
Pleosphaerulina, alfalfa, 249.
Pleosphora, striped maple, 421.
Pseudopeziza, alfalfa, 246.
clover, 254.
Ramularia, red ash, 410.
Taraxacum spp., 461.
Scolecotrichum, timothy, 260.
Septoria, birch, 411.
California buckeye, 411.
cascara, 412.
chrysanthemum, 435.
currant, 373.
horsechestnut, 420.
lettuce, 154.
maple, 421.
pea, 158.
Plantago sp., 458.
salmon berry, 447.
sunflower, 259.
sweet potato, 88.
thimbleberry, 450.
tomato, 53.
western red birch, 410.
Sphaerella, dock, 453.
Sphaeropsis, periwinkle, 443.
Sphaerotheca, gooseberry, 374.
Sphaerulina, clover, 254.
Thielavia, tobacco, 142.
tobacco, 142.
Wisconsin, tobacco, 142.
Leak, potato, 48.
Ledum groenlandicum, (see Labrador tea), 456.
Leersia virginica, (see Homalocenchrus virginicus), 261.
Legumes, 246.
Lemon, (see Citrus), 376.
Lenticel proliferation, apple, 315.
Lentinus lepideus, pine, 407.
Lenzites betulina, paper birch, 411.
Leptosphaeria avenaria, oats, 166, 231.
coniothyrium, apple, 315.
raspberry, 368.
wild rose, 446.
sp., wheat, 166.
wheat, 207.
Leptothyrium dryadearum, (see Mollisia earliana), 363.
pomi, apple, 309.
plum, 350.
Lettuce, Alternaria, 3.
anthracnose, 154.
bacteria, 2.
bacterial disease, 152.
bacterial leaf spot, 152.
bacterial rosette, 152.
bacterial spot, 152.
Bacterium marginale, 152.
bottom rot, 4, 152.
damping off, 154.
downy mildew, 3, 153.
drop, 151.
dwarfing, 152, 154.
foot rot, 154.
frost injury, 152, 154.
gray mold rot, 152.
internal leaf rot, 152.
leaf spot, 153, 154.
mosaic, 154.
rabbit ear, 154.
Rio Grande disease, 153.
root knot, 154.
rot, 152.
Septoria consimilis, 2.
lactucae, 2.
southern blight, 154.
stunting, 154, 155.

tip burn, 152.
white heart, 154.
Liatris graminifolia, Clasterosporium laciniariae, 457.
Lightning injury, maple, 424.
potato, 51.
tomato, 66.
Ligustrum ovalifolium, (see California privet), 444.
Lilac, powdery mildew, 440.
Lima bean, anthracnose, 97.
bacterial blight, 97.
bacterial leaf spot, 97.
downy mildew, 96.
Fusarium, 97.
pod blight, 97.
rust, 97.
stem rot, 97.
yeast spot, 97.
Limb blight, fig, 386.
Lime withertip, Citrus, 383.
Linum spp., rust, 242.
usitatissimum, rust, 242.
Lippia lanceolata, Cercospora lippiae, 457.
Literature, Averrhoa carambola, 388.
banana, 388.
coconut, 392.
olive, 387.
pomegranate, 388.
Little peach, peach, 343.
Locust, heart rot, 420.
white heart rot, 420.
Lodgepole pine mistletoe, lodgepole pine, 400.
Lolium temulentum, Puccinia graminis, 263.
Long tuber, potato, 41.
Lonicera tartarica, powdery mildew, 440.
Loose kernel smut, sorghum, 245.
Loose smut, barley, 220, 467, 468.
oats, 469, 470.
wheat, 176, 463, 464.
Lophodermella montivaga, lodgepole pine, 400.
Lophodermium nervisequium, lowland fir, 395.
pinastri, lodgepole pine, 399.
sugar pine, 400.
western white pine, 401.
western yellow pine, 402.
sp., pine, 407.
white spruce, 408.
Loquat, blight, 388.
scab, 388.
Losses, potato late blight, 8.
(see also crop losses).
Lotus spp., Synchitrium sp., 457.
Ludwigia alternifolia, Septoria ludwigiae, 457.
Lupine, powdery mildew, 440.
Lupinus perennis, powdery mildew, 457.
spp., (see lupine), 440.
Lycium sp., (see matrimony vine), 441.
Lycopodium complanatum flabelliforme, Didymella chamaecyparissi, 457.

M

Maclura pomifera, (see osage orange), 441.
Macrophoma candollei, box, 434.
fici, fig, 386.
parca, lowland fir, 395.
sp., thimbleberry, 450.
white elm, 416.
tumefaciens, black cottonwood poplar, 427.
Macrosporium carotae, carrot, 145.
catalpae, catalpa, 412.
cucumerinum, cucumber, 119.
parasiticum, onion, 99.
solani, eggplant, 150.
potato, 11, 475, 476.
sweet potato, 3, 88.
tomato, 60, 478.
sp., alfalfa, 249.
bur clover, 255.
clover, 255.
turnip, 111.
spp., tomato, 59.
tabacinum, tobacco, 143.
Madrona, leaf blight, 420.
Sphaerella arbuticola, 420.
Magnesium hunger, tobacco, 142.
Mangel, damping off, 155.
leaf blight, 155.
Rhizoctonia sp., 155.
Mango, anthracnose, 387.
bloom drop, 387.
blossom blight, 387.
die-back, 387.
stem end rot, 387.
tear stain, 387.
Manzanita, Exobasidium vaccinii, 457.

leaf rust, 457.
Maple, black specked leaf spot, 423.
chlorosis, 423.
leaf scorch, 424.
leaf spot, 421, 422, 423.
Steganosporium piriforme, 423.
sun scorch, 423.
tar leaf spot, 423.
white butt rot, 423.
wilt, 423.
winter injury, 424.
Maple, dwarf, Cylindrosporium sp., 420.
leaf spot, 420.
Maple, mountain, wood rot, 422.
Maple, Norway, leaf scorch, 421.
Phyllosticta saccharina, 421.
Pleospora papillata, 421.
wilt, 421.
Maple, Oregon, Hypoderma commune, 421.
white heartwood rot, 421.
Maple, red, Pholiota adiposa, 421.
sap rot, 421.
Maple, silver, Pholiota adiposa, 422.
Maple, striped, leaf spot, 421.
Maple, sugar, anthracnose, 422.
Gloeosporium sp., 422.
leaf scorch, 422.
leaf spot, 422.
Phenacoccus sp., 422.
Steganosporium piriforme, 422.
Marasmius plicatus, sugar cane, 131.
Marginal leaf roll, potato, 4, 41.
Marssonia fragariae, (see Mollisia earliana), 363.
strawberry, 364.
juglandis, (see Gnomonia leptostyla), 419, 430.
martini, chestnut oak, 425.
ochroleuca, chestnut, 415.
panattoniana, lettuce, 154.
populi, poplar, 428.
potentillae, (see Mollisia earliana), 363.
strawberry, 364.
sp., poplar, 428.
wild rose, 446.
Matrimony vine, powdery mildew, 441.
rust, 441.
Matting, Alpine fir, 395.
Engelmann spruce, 408.
lowland fir, 395.
Meadow foxtail, (see Alopecurus pratensis), 264.
Measles, apple, 315.
Medicago hispida, (see bur clover), 255.
lupulina, Uromyces medicaginis, 247.
sativa, Uromyces striatus, 247.
Melampsora abietis-canadensis, hemlock, 397.
white poplar, 426.
albertensis, quaking aspen poplar, 427.
bigelowii, willow, 430.
lini, flax, 241.
Linum spp., 242.
Linum usitatissimum, 242.
medusae, Carolina poplar, 426.
poplar, 428.
occidentalis, black cottonwood poplar, 427.
sp., poplar, 428.
willow, 431.
Melampsoropsis abietina, Labrador tea, 456.
cassandrae, black spruce, 408.
ledicola, Labrador tea, 456.
spruce, 408.
piperiana, rhododendron, 444.
rhododendri, rhododendron, 445.
Melanconis, butternut, 412.
juglandis, butternut, 412.
Melanconium betulinum, white birch, 411.
fuligineum, grape, 361.
oblongum, (see Melanconis juglandis 412.
walnut, 430.
Melanose, Citrus, 379.
Melica imperfecta, Urocystis agropyri, 264.
Melilotus spp., (see sweet clover), 255.
Meliola sp., Citrus, 383.
Micropuccinia malvacearum, (see Puccinia malvacearum), 438.
Microsphaera alni, chestnut, 415.
euonymus, 436.
lilac, 440.
pecan, 390.
sweet pea, 449.
sycamore, 430.
Syringa spp., 441.
white oak, 424.
alni extensa, oak, 426.

alni lonicerae, Lonicera tartarica, 440.
diffusa, snowberry, 449.
quercina, (see M. alni extensa), 426.
symphoricarpi, snowberry, 449.
Microstroma album, white oak, 424.
juglandis, hickory, 419.
Mildew, Humulus sp., 456.
Oenothera sp., 458.
red oak, 425.
Mild mosaic, potato, 4.
Millet, Sorosporium syntherismae, 264.
Miscellaneous bark cankers, apple, 314.
Miscellaneous diseases, pear, 328.
Miscellaneous fruit rots, apple, 313.
Miscellaneous grasses, 260.
literature, 265.
Miscellaneous injuries, sweet potato, 87.
Miscellaneous leaf spots, apple, 313.
Miscellaneous plants, 451.
Miscellaneous small fruits, 357.
Miscellaneous vegetable crops, 143.
Mistletoe, plum, 351.
yellow pine, 402.
Mold, clover, 255.
Mollisia earliana, strawberry, 363. 364.
Monarda, Coleosporium naroissi, 441.
fistulosa, rust, 457.
sp., (see monarda), 441.
Monilia sp., pear, 328.
Monilochaetes infuscans, sweet potato, 86.
Morus alba, (see mulberry), 424.
Mosaic, bean, 4, 94, 479, 480.
blackberry, 373.
cantaloupe, 113.
celery, 2, 149.
clover, 255.
control, 5.
corn, 168, 238.
cowpea, 168, 256.
cucumber, 116.
dahlia, 435.
diseases, cereals, 168.
work on, 4.
dwarf, potato, 4, 40.
eggplant, 150.
escarole, 151.
fuchsia, 436.
golden seal, 455.
Hippeastrum johnsonii, 455.
horseradish, 110.
Humulus sp., 456.
lettuce, 154.
mustard, 111.
pepper, 160.
potato, 3, 4, 31, 473, 474.
pumpkin, 119.
raspberry, 369, 490.
red clover, 255.
snapdragon, 449.
Solanum nigrum, 62.
soybean, 167, 168, 257.
spinach, 4, 162.
squash, 119.
sugar beet, 134.
sugar cane, 5, 129.
sweet clover, 168, 255.
sweet pea, 450.
sweet potato, 88.
tobacco, 140.
tomato, 5, 61.
watermelon, 123.
wheat, 166, 168, 215.
wild rose, 447.
Mottled curly dwarf, potato, 4, 41.
Mottled mosaic, potato, 4, 41.
Mottle leaf, Citrus, 383.
Muhlenbergia mexicana, Helminthosporium giganteum, 261.
schreberi, Helminthosporium giganteum, 261.
sp., Phyllachora graminis, 262.
Mulberry, blight, 375.
Sclerotinia carunculoides, 375, 424.
Texas root rot, 375.
Mustard, leaf spot, 111.
mosaic, 111.
powdery mildew, 111.
white rust, 110.
Mycosphaerella brassicicola, cabbage, 108.
cauliflower, 110.
fragariae, strawberry, 362.
grossulariae, currant, 373.
pinodes, pea, 156.
rubi, blackberry, 372.
raspberry, 370.
rubina, raspberry, 370.
sentina, pear, 328.
Myxosporium corticolum, apple, 314.
rosae, wild rose, 446.

Nailhead rust, Citrus, 382.
Nailhead spot, tomato, 59.
Neck rot, onion, 100.
Necrosis, soybean, 257.
Nectria cinnabarina, horsechestnut, 420.
western service berry, 429.
coccinea, apple, 306.
(see Creonectria coccinea), 411.
galligena, apple, 306.
dogwood, 415.
pear, 328.
scarlet oak, 424.
willow, 431.
sp., walnut, 391.
vulgaris, Ribes spp., 459.
western service berry, 429.
Needle blight, lodgepole pine, 400.
parry pinion pine, 403.
western yew, 408.
white pine, 404.
Needle cast, lodgepole pine, 399.
lowland fir, 395.
sugar pine, 400.
western larch, 398.
western white pine, 401.
western yellow pine, 401, 402.
Needle drop, white pine, 404.
Needle rust, Engelmann spruce, 408.
Nematodes, begonia, 434.
carrot, 145.
chicory, 149.
clover, 168, 254.
strawberry, 366.
wheat, 166, 207.
Nematospora phaseoli, lima bean, 97.
Neofabraea malicorticis, apple, 305.
Neottiospora yuccaefolia, yucca, 451.
Net blotch, barley, 222.
Net necrosis, potato, 48.
New abnormality, Digitalis purpurea, 435.
New areas, field diseases, 2.
vegetable diseases, 2.
New diseases, 3.
cereals, 166.
field and vegetable crops, 3.
flax, 166, 244.
tomato, 67.
New hosts, cereal diseases, 166, 167.
New leaf disease, Chinese cabbage, 110.
New localities, cereal diseases, 167.
New occurrences, cereal diseases, 166.
Nummularia discreta, apple, 290.
sp., chestnut, 415.
Nursery leaf blight, pecan, 390.
Nut diseases, 389.
Nut rot, hickory, 419.
Nymphaea odorata, Sphaerella pontederiae, 457.
Nyssa sylvatica, (see black gum), 417.

O

Oak, Angelinia rufescens, 426.
anthracnose, 425.
leaf blister, 425.
leaf chlorosis, 426.
powdery mildew, 426.
red heart rot, 426.
Oak, chestnut, Diplodia suberina, 425.
leaf spot, 425.
Physalospora cydoniae, 425.
Oak, red, mildew, 425.
red heart rot, 425.
sapwood rot, 425.
Oak, scarlet, Armillaria root rot, 424
butt rot, 424.
European canker, 424.
Oak, water, leaf blister, 425.
Oak, white, anthracnose, 424.
powdery mildew, 424.
sap rot, 424.
witches broom, 424.
Oats, anthracnose, 230.
blast, 230.
covered smut, 469, 470.
crop losses, 462, 469, 470.
crown rust, 227, 469, 470.
halo blight, 230.
leaf spot, 231.
Leptosphaeria avenaria, 166.
loose smut, 469, 470.
powdery mildew, 231.
scab, 231.
smut, 166, 224.
speckled blotch, 231.
stem rust, 226, 469, 470.
sterility, 230.
Ocean spray, powdery mildew, 441.
Oenothera sp., mildew, 458.
Oidium evonymi japonici, Japanese euonymus, 436.
oospora lactis, tomato, 67.
sp., catalpa, 413.
mustard, 111.

oak, 426.
red oak, 425.
Oil burn, Citrus, 383.
Okra, root knot, 155.
root rot, 155.
Texas root rot, 155.
wilt, 155.
Olive, literature, 387.
Olpitrichum carpophilum, cotton, 128.
Onion, anthracnose, 99.
bacterial soft rot, 100.
black mold, 100.
downy mildew, 99.
leaf mold, 99.
neck rot, 100.
pink root, 100.
rot, Fuarium, 100.
slimy soft rot, 100.
smudge, 99.
smut, 3, 5, 97, 99.
Ophiobolus cariceti, Agropyron repens, 262.
Agrostis palustris, 167, 262.
Bromus secalinus, 262.
Phleum pratense, 167.
Poa compressa, 167, 262.
rye, 219.
timothy, 260.
wheat, 203.
tenellus, Erigeron annuus, 453.
Orange, (see Citrus), 376.
Orange rust, raspberry, 371.
Orchard disease surveys, apple, 318.
Ornamentals, 432.
Osage orange, rust, 441.
Osmunda claytoniana, fir-fern rust, 395.
Otthia crataegi, hawthorn, 418.
Oxalis, rust, 442.
sp., (see oxalis), 442.
Ozonium omnivorum, alfalfa, 248.
apple, 311.
bean, 96.
cotton, 126.
cowpea, 256.
elm, 417.
grape, 361.
hollyhock, 439.
mulberry, 375.
okra, 155.
peach, 344.
peanut, 160.
pear, 328.
sweet potato, 88.
wild rose, 446.

P

Pachyma cocos, (see Poria cocos), 407.
Pacific Slope yellow pine mistletoe, western yellow pine, 402.
Paeonia officinalis, (see peony), 402.
Palm, Alternaria sp., 442.
false smut, 442.
Gloeosporium sp., 442.
leaf blight, 442.
leaf spot, 442.
Pestalozzia sp., 442.
Panicum anceps, Helminthosporium giganteum, 261.
clandestinum, Helminthosporium giganteum, 261.
dichotomiflorum, Helminthosporium giganteum, 261.
gattingeri, Helminthosporium giganteum, 261.
miliaceum, Ustolago panici-miliacei, 264.
Pansy, powdery mildew, 442.
rust, 442.
Parsley, bacterial wilt, 155.
leaf spot, 2, 155.
Parthenium integrifolium, rust, 458.
Pasmo, flax, 244.
Pea, anthracnose, 159.
Ascochyta blight, 156.
bacterial blight, 158.
blight, 156.
damping off, 159.
downy mildew, 159.
frost injury, 159.
leaf spot, 158.
powdery mildew, 156.
root rot, 2, 157.
Fusarium, 2, 157.
Pythium, 2, 157.
Rhizoctonia, 2, 157
Thielavia, 157.
rough pod spot, 159.
rust, 2, 159.
Septoria pisi, 3.
undetermined disease, 159.
Peach, bacterial shot hole, 341.
bacterial spot, 340.
black mold rot, 342.
blight, Coryneum, 342.

brown rot, 330, 484, 485.
chlorosis, 345.
crop losses, 462, 484, 485.
crown gall, 344.
die-back, 344.
frost injury, 273, 345.
frosty mildew, 344.
increase in production, 268.
leaf curl, 335, 484, 485.
little peach, 343.
phony peach, 344.
powdery mildew, 344.
root knot, 343.
root rot, 344.
Armillaria, 344.
Clitocybe, 344.
Ozonium, 344.
rosette, 343.
rust, 342.
scab, 338, 484, 485.
shot hole, 344.
split pit, 345.
spray injury, 345.
sunscald, 345.
wilt, Verticillium, 344.
yellows, 343.
Peanut, bacterial wilt, 159.
chlorosis, 160.
leaf spot, 159.
southern blight, 160.
Texas root rot, 160.
Pear, bitter pit, 328.
black end, 328.
black leaf, 328.
black rot, 328.
blight, bacterial, 322.
blossom blight, 329.
canker, Nectria, 328.
Septobasidium, 328.
Corticium stevensii, 328.
crop losses, 486, 487.
crown gall, 328.
European canker, 328.
fire blight, 486, 487.
foliage scalding, 328.
frost injury, 273, 329.
heart rot, 328.
increase in production, 268.
leaf blight, 327, 486, 487.
leaf spot, 328.
physiological canker, 328.
powdery mildew, 328.
root rot, Ozonium, 328.
scab, 326, 486, 487.
sooty blotch, 328.
sour sap, 328.
spray injury, 329.
twig blight, 328.
Pecan, anthracnose, 390.
black pit, 390.
brown leaf spot, 390.
crown gall, 390.
Hypochnus sp., 390.
nursery leaf blight, 390.
powdery mildew, 390.
rosette, 390.
scab, 389.
Pelargonium sp., (see geranium), 436.
Penicillium, apple, 314.
expansum, apple, 313.
plum, 350.
sp., hickory, 419.
spp., Citrus, 381.
Pennisetum japonicum, Helminthosporium giganteum, 261.
Pennsylvania, white pine blister rust control, 405.
Peony, blight, 442.
bud rot, 442, 443.
leaf spot, 442, 443.
root knot, 443.
rot, 443.
Pepper, bacterial spot, 160.
fruit rot, 160.
leaf spot, 160.
mosaic, 160.
wilt, 160.
Peppery spot, cauliflower, 109.
Peridermium carneum, (see Coleosporium vernoniae), 400.
comptoniae, (see Cronartium comptoniae), 399.
delicatulum, (see Coleosporium delicatulum), 400.
helianthi, (see Coleosporium helianthi), 400.
peckii, (see Pucciniastrum myrtilli), 396, 397.
terebinthinaceae,(see Coleosporium terebinthinaceae), 400.
Perisporium wrightii, cactus, 451.
Periwinkle, bastard blossom, 443.
leaf spot, 443.
Peronospora effusa spinach, 161.
parasitica, cabbage, 108.
radish, 111.

potentillae, Duchesnea indica, 453.
schleideni, onion, 99.
sp., soybean, 166, 256.
trifoliorum, alfalfa, 248.
soybean, 257.
trifoliorum manshurica, soybean, 257.
viciae, pea, 159.
Persimmon, leaf spots, 387.
rot, 387.
Pestalozzia funerea, common juniper, 397.
juniper, 398.
guepini vaccinii, rhododendron, 445.
inquinans, camellia, 434.
palmarum, palm, 442.
sp., avocado, 386.
camphor, 412.
cranberry, 375.
palm, 442.
Peziza earliana, (see Mollisia earliana), 363.
Pezizella lythri, strawberry, 365.
Phalaris arundinacea, Helminthosporium giganteum, 261.
canariensis, Puccinia glumarum, 263.
Phenacoccus sp., sugar maple, 422.
Philadelphus sp., (see syringa), 450.
Philospora sp., China aster, 433.
Phleospora irregulare, (see Septoria irregularis, 459.
Phleum pratense, Helminthosporium giganteum, 261.
Ophiobolus cariceti, 167.
Phlox, powdery mildew, 443.
sp., (see phlox), 443.
Phlyctaena linicola, flax, 244.
Phoenix canariensis, (see date), 386.
dactylifera, (see date), 386.
Pholiota adiposa, red maple, 421.
silver maple, 422.
praecox, lavender, 440.
Phoma abietina, (see Fusicoccum abietinum), 395.
apiicola, celery, 149.
apple, 314.
betae, sugar beet, 133, 134.
destructiva, tomato, 66.
fruit rot, tomato, 66.
lingam, brussels sprouts, 109.
cabbage, 106.
cauliflower, 110.
palmicola, Washingtonia filifera, 450.
pomi, apple, 304.
quince, 330.
sp., asparagus fern, 432.
soybean, 257.
subcircinata, (see Diaporthe phaseolorum), 97.
sugar beet, 134.
Phomopsis californica, Citrus, 381.
citri, Citrus, 379, 380, 382.
cranberry, 375.
juniperovora, arborvitae, 394.
pseudotsugae, balsam fir, 395.
Douglas fir, 396.
hemlock, 396, 397.
Japanese larch, 396, 399.
western hemlock, 397.
western larch, 399.
sojae, soybean, 166, 257.
vexans, eggplant, 149, 150.
Phony peach, peach, 344.
Phoradendron flavescens, plum, 351.
Phragmidium imitans, raspberry, 371.
montivagum, wild rose, 446.
potentillae-canadensis, Potentilla canadensis, 458.
rosae-californicae, wild rose, 446.
sp., Rubus parviflorus, 459.
spp., wild rose, 446.
Phycomycete, hickory, 419.
Phyllachora graminis, Agropyron repens, 262.
Elymus canadensis, 262.
Hystrix patula, 262.
Muhlenbergia sp., 262.
pomigena, apple, 309.
pear, 328.
trifolii, clover, 255.
red clover, 255.
white clover, 255.
ulmi, (see Gnomonia ulmea), 415.
Phyllactinia corylea, dogwood, 415.
mountain alder, 409.
western red birch, 411.
western service berry, 429.
white elm, 416.
Phyllostachys sp., rust, 458.
Phyllosticta acericola, (see P. minima), 423.
ampelopsidis, (see Guignardia bidwellii), 432.
antirrhini, snapdragon, 448.
apple, 314.
batata, sweet potato, 88.

caryae, pecan, 390.
catalpae, catalpa, 412, 413.
hamamelidis, witch-hazel, 431.
horizontalis, cotoneaster, 435.
hydrangeae, hydrangea, 439.
minima, box elder, 421.
dwarf maple, 420.
maple, 423.
sugar maple, 422.
negundinis, (see P. minima), 421.
podophylli, Podophyllum peltatum, 458.
potentillae, (see Mollisia earliana), 363.
rhubarb, 2.
saccharina, Norway maple, 421.
solitaria, apple, 283, 482.
sp., hickory, 419.
persimmon, 387.
poplar, 428.
sugar maple, 422.
willow, 431.
spp., maple, 423.
tobacco, 143.
straminella, rhubarb, 160.
tilliae, basswood, 410.
violae, violet, 450.
Physalospora cydoniae, apple, 291, 482.
chestnut oak, 425.
pear, 328.
quince, 330.
Physarum cinereum, cucumber, 119.
lawn grass, 262.
gyrosum, celery, 149.
sp., asparagus fern, 433.
Physiological canker, pear, 328.
Physiological factors, fuchsia, 436.
Physoderma zeae-maydis, corn, 237, 471.
Physopella fici, fig, 384.
osage orange, 441.
vitis, grape, 361.
Phytophthora cactorum, apple, 314.
rhubarb, 160.
celery, 149.
cryptogea, tomato, 65.
infestans, potato, 8, 473, 474.
tomato, 66.
lettuce, 154.
parasitica rhei, rhubarb, 160.
parasitica, tomato, 65.
phaseoli, lima bean, 96.
sp., hackberry, 417.
peony, 443.
Sedum purpureum, 459.
syringae, apple, 314.
terrestris, Citrus, 382.
eggplant, 150.
tomato, 66.
Picea canadensis, (see white spruce), 408.
engelmanni, (see Engelmann spruce), 408.
mariana, (see black spruce), 408.
spp., (see spruce), 408.
Pine, anthracnose, 407.
Daedalea berkeleyi, 407.
Lophodermium blight, 407.
pine cone rusts, 408.
Poria cocos, 407.
root rot, 408.
scaly Lentinus rot, 407.
tuckahoe, 407.
Pine, Arizona longleaf, rust, 400.
Pine, Austrian, Sphaeropsis sp., 401.
Pine comandra rust, western yellow pine, 402.
Pine cone rusts, pine, 408.
Pine, Corsican, rust, 401.
Pine, jack, rust, 400.
Pine, loblolly, rusts, 407.
Septoria acicola, 407.
Pine, lodgepole, lodgepole-pine mistletoe, 400.
Lophodermella montivaga, 400.
needle blight, 400.
needle cast, 399.
red-brown heartwood butt rot, 400.
rust, 399.
Stillospora pinicola, 400.
western fusiform rust, 399.
western pine gall rust, 399.
Pine, longleaf, rusts, 401.
Pine, parry pinion, needle blight, 403
Pine, pitch, Coleosporium terebinthinaceae, 403.
dying of needles, 403.
Hypoderma desmazieri, 403.
rust, 403.
Pine, pond, rusts, 403.
Pine, red, damping off, 403.
rust, 403.
wood rot, 403.
Pine, Scotch, damping off, 407.
Dothiorella pinastri, 407.
Pine, scrub, Cronartium cerebrum, 407.
rusts, 407.

Pine, shortleaf, rusts, 400.
Pine, slash or swamp, rust, 399.
Pine, sugar, needle cast, 400.
Pine, western white, needle cast, 401.
ring scale rot, 401.
white pine blister rust, 401.
yellow root rot, 401.
Pine, western yellow, heart rot, 402.
needle cast, 401, 402.
Pacific Slope yellow pine mistletoe, 402.
pine comandra rust, 402.
western pine gall rust, 402.
witches broom, 401.
Pine, white, ant canker, 404.
blister rust control in Pennsylvania, 405.
chemical injury, 404.
Cryptosporium pini, 404.
damping off, 404.
dry rot, 403.
Fusicoccum sp., 404.
leaf cast, 404.
needle blight, 404.
needle drop, 404.
Polyporus schweinitzii, 404.
Septobasidium pinicola, 404.
sunscald, 404.
white pine blister rust, 404.
wood rot, 403.
Pine, yellow, mistletoe, 402.
rot, 402.
white pouch fungus, 402.
Pink root, onion, 100.
Pink rot, apple, 313.
Pinus banksiana, (see jack pine), 400.
caribaea, (see slash or swamp pine), 399.
contorta, (see lodgepole pine), 399.
divaricata, (see jack pine), 400.
echinata, (see shortleaf pine), 400.
lambertiana, (see sugar pine), 400.
monticola, (see western white pine), 401.
Septobasidium pinicola, 404.
murrayana, (see Arizona longleaf pine), 400.
nigra austriaca, (see Austrian pine), 401.
nigra poiretiana, (see Corsican pine) 401.
palustris, (see longleaf pine), 401.
ponderosa, (see western yellow pine), 401.
(see also yellow pine), 402.
quadrifolia, (see parry pinion pine), 403.
resinosa, (see red pine), 403.
rigida, (see pitch pine), 403.
serotina, (see pond pine), 403.
spp., (see pine), 407.
strobus, (see white pine), 403.
sylvestris, (see Scotch pine). 407.
taeda, (see loblolly pine), 407.
virginiana, (see scrub pine), 407.
Piricularia grisea, Syntherisma sanguinalis, 262.
oryzae, rice, 240.
Pithiness, sweet potato, 87.
Plantago sp., leaf spot, 458.
Plasmodiophora brassicae, cabbage, 100.
cauliflower, 110.
Plasmopara halstedii, sunflower, 259.
viticola, grape, 358.
Platanus occidentalis, (see sycamore) 429.
Pleotodiscella veneta, blackberry, 372
raspberry, 367.
Plenodomus destruens, sweet potato, 85, 477.
Pleosphaerulina briosiana, alfalfa, 249.
Pleospora papillata, Norway maple, 421
sp., striped maple, 421.
Plowrightia morbosa, black cherry, 413
cherry, 354.
plum, 350.
western choke cherry, 413.
Plum, bacterial gummosis, 350.
bacterial spot, 349.
black knot, 350.
blue mold rot, 350.
brown rot, 346, 488.
chlorosis, 351.
cork spot, 351.
crop losses, 488.
crown gall, 350.
fly speck, 350.
frost injury, 351.
gray mold rot, 350.
gum spot, 351.
hard flesh spots, 351.
internal browning, 351.

leaf blight, 349.
mistletoe, 351.
pockets, 348.
Rhizopus rot, 350.
rosette, 350.
rust, 350.
scab, 350.
silver leaf, 351.
sooty blotch, 350.
spray injury, 351.
Stereum, 351.
top soursap, 351.
yellows, 350.
Poa compressa, Ophiobolus cariceti, 167, 262.
pratensis, Erysiphe graminis, 261.
Helminthosporium giganteum, 261.
Helminthosporium sp., 262.
Puccinia poarum, 263.
Ustilago striaeformis, 264.
Pockets, plum, 348.
Pod blight, lima bean, 97.
soybean, 257.
Pod rot, bean, 96.
Pod spot, bean, 96.
Podophyllum peltatum, Phyllosticta podophylli, 458.
Podosphaera leucotricha, apple, 306.
pear, 328.
oxyacanthae, black cherry, 413.
cherry, 354.
choke cherry, 413.
ocean spray, 441.
quince, 330.
Poinsettia, leaf spot, 443.
Pole sweat, tobacco, 142.
Polyporus betulinus, paper birch, 411.
eurbescens, yellow pine, 402.
fusous, paper birch, 411.
inzeugae, poplar, 429.
picipes, white ash, 409.
resinosus, (see P. fusous), 411.
schweinitzii, Douglas fir, 395.
giant arborvitae, 394.
lodgepole pine, 400.
western larch, 399.
white pine, 404.
sp., apple, 315.
sulphureus, black cherry, 413.
oak, 426.
red oak, 425.
red pine, 403.
western larch, 399.
white elm, 416.
volvatus, Douglas fir, 396.
yellow pine, 402.
Polystictus pergamenus, red oak, 425.
Polythrincium trifolii, clover, 255.
white clover, 255.
Pome fruits, diseases, 273.
Pomegranate, literature, 388.
Poor stands, potato, 45.
Poplar, anthracnose, 428.
canker, 427.
European canker, 428.
leaf spot, 428.
Melampsora sp., 428.
Polyporus inzeugae, 429.
powdery mildew, 428.
rust, 428.
wood rot, 429.
Poplar, Balm of Gilead, canker, 426.
Poplar, black cottonwood, canker, 427.
gall, 427.
leaf rust, 427.
powdery mildew, 427.
yellow leaf blister, 427.
Poplar, Carolina, canker, 426.
rust, 426.
Poplar, large toothed aspen, Trametes suaveolens, 426.
Poplar, Lombardy, canker, 426.
Poplar, quaking aspen, canker, 427.
Fomes igniarius, 427.
leaf rust, 427.
powdery mildew, 427.
tar spot, 427.
Poplar, white, rust, 426.
Populus alba, (see white poplar), 426.
balsamifera, (see Balm of Gilead poplar), 426.
deltoides, (see Carolina poplar), 426.
grandidentata, (see large toothed aspen poplar), 426.
nigra italica, (see Lombardy poplar), 426.
spp., (see poplar), 427.
tremuloides, (see quaking aspen poplar), 427.
trichocarpa, (see black cottonwood poplar), 427.
Poria cocos, pine, 407.
vaporaria, arborvitae, 394.
Poronidulus conchifer, elm, 417.
white elm, 416.

Potash hunger, cotton, 129.
Potato, anthracnose, 46.
bacterial wilt, 46.
black dot, 46.
black heart, 50.
blackleg, 3, 28, 473, 474.
calico, 4, 41, 42.
Cercospora concors, 46.
common scab, 24.
corrugated mosaic, 41.
crinkle, 4, 41.
crop loss, 462, 473, 474, 475, 476.
curly dwarf, 4, 41, 48.
decaying seed pieces, 45.
degeneration diseases, 40.
drought injury, 51.
early blight, 11, 475, 476.
fertilizer burning, 52.
freezing injury, 51.
Fusarium wilt, 14, 475, 476.
germination diseases, 43.
giant hills, 3, 4, 41.
hail injury, 51.
heat necrosis, 51.
hollow heart, 50.
hopperburn, 37, 475, 476.
internal brown spot, 50.
jelly end rot, 48.
late blight, 3, 4, 8, 473, 474.
leaf drop, 4, 41.
leaf hopper, 37.
leaf roll, 4, 35, 473, 474.
leaf rolling mosaic, 4, 40.
leak, 48.
lightning injury, 51.
long tuber, 41.
losses from late blight, 8.
marginal leaf roll, 4, 41.
mild mosaic, 4.
mosaic, 3, 4, 31, 473, 474.
mosaic, dwarf, 4, 40.
mottled curly dwarf, 4, 41.
mottled mosaic, 4, 41.
net necrosis, 48.
poor stands, 45.
powdery dry rot, 48.
powdery scab, 48.
rhizoctonia, 19, 473, 474.
root knot, 48.
root rot, Armillaria, 48.
rot, 48.
rugose mosaic, 4.
russet dwarf, 4, 41, 42.
scab, 5.
scald, 49.
sclerotial disease, 46.
scurf, 17.
seed certification, 6.
severe mosaic, 4, 41.
silver scurf, 48.
slimy soft rot, 48.
southern blight, 46.
spindle sprout, 4, 41.
spindle tuber, 4, 41.
spray injury, 51.
stem end rot, 47.
stem rot, 19.
stipple streak, 4, 41.
streak, 4, 41, 42.
tip burn, 37, 475, 476.
tuber indexing, 6.
tuber rots, 47.
use of sulphur, 45.
wart, 4, 17.
wilt, Fusarium, 47, 475, 476.
Verticillium, 47.
yellow dwarf, 3, 43.
Potentilla canadensis, rust, 458.
Powdery dry rot, potato, 48.
Powdery mildew, ampelopsis, 432.
apple, 306.
barley, 224.
bean, 95.
black cherry, 413.
black cottonwood poplar, 427.
catalpa, 413.
cherry, 354.
chestnut, 415.
choke cherry, 413.
chrysanthemum, 435.
clover, 163, 250.
cowpea, 256.
cucumber, 119.
dahlia, 435.
dogwood, 415.
euonymus, 436.
golden glow, 438.
grape, 359.
horsechestnut, 420.
Japanese euonymus, 436.
lilac, 438.
Lonicera tartarica, 440.
lupine, 240.
Lupinus perennis, 457.
matrimony vine, 441.
mountain alder, 409.

mustard, 111.
oak, 426.
oats, 231.
ocean spray, 441.
pansy, 442.
pea, 156.
peach, 344.
pear, 328.
pecan, 390.
phlox, 443.
poplar, 428.
quaking aspen poplar, 427.
quince, 330.
radish, 111.
raspberry, 371.
red clover, 166.
rose, 445.
rye, 217.
snowberry, 449.
spiraea, 449.
strawberry, 365.
sunflower, 259.
sweet pea, 449.
sycamore, 430.
Taraxacum spp., 460.
Vicia americana, 461.
violet, 450.
western red birch, 411.
western service berry, 429.
wheat, 214.
white elm, 416
white oak, 424.
willow, 431.
zinnia, 451.
Powdery sapwood rot, paper birch, 411.
Powdery scab, potato, 48.
Pox canker, apple, 315.
Pox, sweet potato, 86, 477.
Precipitation map, 9.
Primrose, gray mold, 444.
Primula sp., (see primrose), 444.
Privet, California, shot hole, 444.
Progress in development of control measures, 5.
Proliferation of spike, timothy, 260.
Protocoronospora nigricans, vetch, 258.
Prune, (see plum), 346, 488.
Prunus americana x trifolora, hard flesh spots, 351.
demissa, (see western choke cherry), 413.
melanocarpa, (see choke cherry), 413.
serotina, (see black cherry), 413.
triloba plena, Bacillus amylovorus, 325.
fire blight, 444.
virginiana, (see choke cherry), 413.
Pseudomonas aptatum, swiss chard, 163.
avenae, (see Bacterium coronafaciens), 230.
pisi, pea, 158.
tumefaciens, (see Bacterium tumefaciens), 308.
Pseudoperonospora cubensis, cantaloupe, 113.
cucumber, 118.
pumpkin, 119.
squash, 119.
watermelon, 123.
humuli, Humulus lupulus, 456.
Pseudopeziza medicaginis, alfalfa, 246.
ribis, currant, 373.
gooseberry, 374.
trifolii, clover, 254.
Pseudotsugae taxifolia, (see Douglas fir), 395.
Psoralea lanceolata, rust, 458.
Psorosis, Citrus, 382.
Pteridium aquilinum pubescens, (see brake fern), 454.
Puccinia agropyri, clematis, 436.
Thalictrum dioicum, 461.
antirrhini, snapdragon, 447.
asparagi, asparagus, 143.
centaureae, bachelors button, 433.
clematidis, Agropyron spp., 252.
Agropyron tenerum, 262.
Bromus spp., 262.
Elymus spp., 262.
coronata, Avena sp., 262.
buckthorn, 411.
cascara, 412.
Festuca elatior, 262.
oats, 227, 469, 470.
Rhamnus cathartica, 229.
cynodontis, Capriola dactylon, 262.
dispersa, rye, 216, 465, 466.
elegans, (see Uromyces elegans), 253
glumarum, Agropyron acutum, 263.
Agropyron longifolium, 263.
tenerum longifolium, 263.
barley, 196, 221.
Bromus adoensis, 263.
erectus, 263.
lanuginosus, 263.
macrostachys, 263.

Bromus maximus, 263.
porteri frondosus, 263.
purgans latiglumis, 263.
richardsonii, 263.
rigidus, 263.
grasses, 167, 263.
Hordeum bulbosum, 263.
jubatum, 197, 263.
maritimum, 263.
nodosum, 197, 263.
Phalaris canariensis, 263.
wheat, 196.
wild grasses, 263.
graminis, Agropyron caninum, 263.
Agropyron repens, 263.
Smithii, 263.
tenerum, 263.
Agrostis palustris, 263.
Alopecurus geniculatus, 263.
barley, 220, 467, 468.
Bromus sp., 263.
Dactylis glomerata, 263.
Elymus canadensis, 263.
virginicus, 263.
grasses, 263.
Hordeum jubatum, 263.
Lolium temulentum, 263.
oats, 226, 469, 470.
rye, 215, 465, 466.
wheat, 184, 463, 464.
grossulariae, gooseberry, 374.
helianthi, Helianthus spp., 455.
sunflower, 259.
heucherae, Heuchera glabra, 455.
impatientis, Impatiens balsamina, 439.
lateritia, Diodia teres, 453.
lycii, matrimony vine, 441.
malvacearum, hibiscus, 438.
hollyhock, 438.
melanocephala, Phyllostachys sp., 458.
menthae americana, Monarda fistulosa, 457.
peridermiospora, ash, 410.
green ash, 409.
white ash, 409.
phlei-pratensis, timothy, 260.
poarum, Poa pratensis, 263.
pruni-spinosae, anemone, 342.
choke cherry, 413.
peach, 342.
plum, 350.
rhamni, (see P. coronata), 412.
ribis, Ribes spp., 459.
ruelliae, Ruellia strepens, 459.
simplex, barley, 167, 221, 467-8.
sorghi, corn, 233, 471.
spermacoces, (see P. lateritia), 453.
subnitens, Distichlis spicata, 263.
spinach, 3, 161.
taraxaci, Taraxacum spp., 460.
triticina, wheat, 192, 463, 464.
violae, pansy, 442.
Pucciniastrum myrtilli, Gaylussacia sp., 454.
hemlock, 396, 397.
Vaccinium sp., 461.
Vaccinium spp., 461.
pustulatum, fireweed, 454.
sparsum, manzanita, 457.
Pueraria thunbergiana, (see kudzu), 440.
Pumpkin, downy mildew, 119.
mosaic, 119.
Purple sheath spot, corn, 240.
Purple tatula, (see Datura tatula), 453.
Pyrenopeziza medicaginis, alfalfa, 248.
Pyrus sitchensis, (see mountain ash), 410.
spp., (see flowering crab), 436.
Pythiacystis citrophthora, Citrus, 382.
Pythium, celery, 149.
debaryanum, cucumber, 119.
dahlia, 435.
pea, 157.
potato, 48.
spinach, 162.
sugar beet, 134.
sweet pea, 450.
tobacco, 143.
tomato, 65.
watermelon, 122.
lettuce, 154.
pea, 2.
sp., Agrostis palustris, 166, 264.
grasses, 166.
lettuce, 154.
pea, 157.
sugar beet, 134.
watermelon, 3.

Quercus alba, (see white oak), 424.
nigra, (see water oak), 452.
coccinea, (see scarlet oak), 424.
prinus, (see chestnut oak), 425.
rubra, (see red oak), 425.
spp., (see oak), 425.
Quince, black rot, 330.
fire blight, 329.
fruit spot, 330.
leaf blight, 329.
powdery mildew, 330.
rust, 330.
Quince, Japanese flowering, rust, 444.

R

Rabbit ear, lettuce, 154.
Radish, black root, 111.
damping off, 111.
downy mildew, 111.
Erysiphe polygoni, 3.
powdery mildew, 111.
white rust, 111.
Rainfall by months, 269.
by states, 271.
Ramularia fraxinea, red ash, 410.
ginseng, 151.
taraxaci, Taraxacum spp., 461.
Raspberry, anthracnose, 367.
bacterial blight, 371.
blue mold rot, 371.
blue stem, 371.
cane blight, 368, 371.
crop losses, 490.
crown gall, 368.
eastern blue stem, 369.
fruit rot, 371.
gray mold rot, 371.
leaf curl, 369, 490.
leaf spot, 370.
mosaic, 369, 490.
orange rust, 371.
powdery mildew, 371.
Rhizopus rot, 371.
rust, 371.
spur blight, 370.
winter injury, 371.
Ravenelia australis, acacia, 409.
Razoumofskya americana, lodgepole pine, 400.
campylopoda, western yellow pine, 402.
yellow pine, 402.
douglasii, Douglas fir, 396.
laricis, western larch, 399.
Red-brown heartwood butt rot, Douglas fir, 395.
giant arborvitae, 394.
lodgepole pine, 400.
western larch, 399.
Red-brown sapwood rot, Douglas fir, 395.
lowland fir, 395.
Red clover, mosaic, 255.
nematode, 254.
powdery mildew, 166, 250, 251.
root rot, 253.
rusts, 253.
sooty spot, 255.
(see clover), 250.
Red heart rot, oak, 426.
red oak, 425.
white elm, 416.
Red leaf spot, cranberry, 375.
Red rot, Douglas fir, 395.
sugar cane, 130.
Red top, brown patch, 260.
References, tomato diseases, 67.
Relative prevalence, cereal diseases in 1922, 166.
Resistant varieties, 4.
Rhamnus cathartica, crown rust, 229.
purshiana, (see cascara), 412.
sp., (see buckthorn), 411.
Rheosporangium aphanidermatus, radish, 111.
Rhizoctonia, bean, 2.
flax, 244.
medicaginis, alfalfa, 249.
microsclerotia, fig, 385.
pea, 2.
potato, 19, 473, 474.
rice, 241.
solani, bent grass, 260.
blue grass, 260.
cabbage, 109.
fescue grass, 260.
lettuce, 152.
potato, 473, 474.
red pine, 403.
red top, 260.
Scotch pine, 407.
tomato, 65.
white pine, 404.
sp., beet, 145.
celery, 149.
cotton, 128.

eggplant, 150.
horseradish, 110.
mangel, 155.
pea, 157.
radish, 111.
rice, 241.
sugar beet, 134.
sweet pea, 450.
stem rot, bean, 96.
strawberry, 365.
turnip, 111.
watermelon, 3, 123.
wheat, 207.
Rhizopus, apple, 314.
grape, 361.
nigricans, persimmon, 387.
potato, 48.
strawberry, 365.
plum, 350.
raspberry, 371.
sp., guava, 387.
peach, 342.
persimmon, 387.
sweet potato, 83.
spp., sweet potato, 83.
tomato, 67.
squash, 119.
Rhododendron californicum, (see rhododendron), 444.
leaf rust, 444.
leaf spot, 444, 445.
Melampsoropsis rhododendri, 445.
nudiflorum, (see rhododendron), 444.
sp., (see rhododendron), 445.
witches broom, 444.
Rhubarb, Alternaria, 2.
Ascochyta rhei, 2.
Cercospora, 2.
crown rot, 160.
leaf spot, 160.
Phyllosticta, 2.
stalk rot, 160.
undetermined disease, 160.
Rhus diversiloba, Septoria irregularis, 459.
sp., Septoria irregularis, 459.
Rhynchosporium secalis, barley, 167, 223.
rye, 219.
Rhytisma acerinum, Acer rubrum, 423.
Acer saccharinum, 423.
maple, 423.
punctatum, maple, 423.
salicinum, willow, 431.
sp., maple, 423.
vaccinii, Vaccinium corymbosum, 461.
Ribes cynosbati, white pine blister rust, 405.
nigrum, white pine blister rust, 405.
rotundifolium, white pine blister rust, 405.
spp., nectria vulgaris, 459.
rust, 459.
Rice, acreage of United States, 240.
blast, 240.
foot rot, 241.
straighthead, 240.
Ring scale rot, western hemlock, 397.
western larch, 399.
western white pine, 401.
Ring spot, cabbage, 108.
cauliflower, 110.
tobacco, 142.
Rio Grande disease, borage, 451.
carrot, 3, 145.
lettuce, 153.
Ripe rot, apple, 314.
grape, 361.
Robinia pseudacacia, (see locust), 420.
Roestelia pyrata, (see Gymnosporangium juniperi-virginianae), 436.
Root disease, beet, 145.
Root knot, alfalfa, 249.
almond, 391.
apricot, 356.
bean, 96.
beet, 145.
cabbage, 109.
cantaloupe, 114.
carnation, 434.
celery, 149.
chicory, 149.
cotton, 128, 481.
cucumber, 119.
dahlia, 435.
fig, 386.
golden seal, 454.
lettuce, 154.
okra, 155.
peach, 343.
peony, 443.
potato, 48.
sweet clover, 255.
sweet potato, 88.

swiss chard, 163.
tobacco, 143.
tomato, 64.
velvet bean, 259.
watermelon, 123.
Root rot, alfalfa, 249.
apple, 310, 311.
Armillaria, apple, 311.
peach, 244.
potato, 48.
scarlet oak, 424.
bacterial, horseradish, 110.
bean, 2, 4, 479, 480.
black, tobacco, 138.
Clitocybe, grape, 361.
peach, 344.
clover, 253.
corn, 233.
Corticium, strawberry, 366.
Fomes, currant, 373.
Fusarium, barley, 223.
bean, 2, 95.
clover, 253.
corn, 233, 471, 472.
pea, 2, 157.
strawberry, 365.
sweet clover, 255.
Gibberella, corn, 233.
Hypholoma, apple, 311.
Marasmius, sugar cane, 131.
Ozonium, alfalfa, 248.
apple, 311.
bean, 96.
cotton, 126.
cowpea, 256.
grape, 361.
hollyhock, 439.
mulberry, 375.
okra, 155.
peach, 344.
peanut, 160.
pear, 328.
sweet potato, 88.
pea, 2.
peach, 344.
Phoma, celery, 149.
pine, 408.
Pythium, dahlia, 435.
pea, 2, 157.
sweet pea, 450.
Rhizoctonia, alfalfa, 249.
bean, 2.
celery, 149.
horseradish, 110.
pea, 2, 157.
strawberry, 365.
sweet pea, 450.
Sclerotinia, alfalfa, 248.
clover, 253.
strawberry, 365.
Thielavia, bean, 2.
horseradish, 110.
pea, 157.
tobacco, 5.
unknown, golden seal, 455.
wheat, 206, 207.
Xylaria, apple, 310.
hackberry, 417.
Root trouble, cherry, 355.
Rosa spp., (see rose), 445.
(see wild rose), 446.
Rosebloom, cranberry, 374, 375.
Rose, leaf blotch, 445.
powdery mildew, 445.
Rosellinia caryae, hickory, 419.
Rosette, apple, 315.
peach, 343.
pecan, 390.
plum, 350.
wheat, 205.
Rose, wild, anthracnose, 446.
Botrytis rot, 446.
cane blight, 446.
canker, 446.
chlorosis, 447.
crown gall, 446.
leaf rust, 446.
leaf spot, 446.
mosaic, 447.
rust, 446.
Texas root rot, 446.
winter injury, 447.
Rot, Alternaria, apple, 314.
bacterial, lettuce, 152.
Botrytis, artichoke, 143.
wild rose, 446.
Cephalosporium, apple, 314.
Dothichiza, apple, 314.
Fusarium, apple, 314.
asparagus, 144.
gladiolus, 438.
onion, 100.
Penicillium, apple, 314.
Pezizella, strawberry, 365.
Phoma, apple, 314.
sugar beet, 134.

Phyllosticta, apple, 314.
Polyporus, Douglas fir, 396.
yellow pine, 402.
Pythium, potato, 43.
Rhizopus, apple, 314.
grape, 361.
persimmon, 387.
plum, 350.
potato, 48.
raspberry, 371.
squash, 119.
strawberry, 365.
Sclerotinia, peony, 443.
strawberry, 365.
Trichoderma, sweet potato, 87.
Rough pod spot, pea, 159.
Rubus parviflorus, rust, 459.
(see thimble berry), 450.
spectabilis, (see salmon berry), 447.
Rudbeckia laciniata, (see golden glow), 438.
Ruellia strepens, rust, 459.
Rugose mosaic, potato, 4.
Rumex occidentalis, (see dock), 453.
Russet dwarf, potato, 4, 41, 42.
Rust, alfalfa, 166, 247.
anemone, 342.
apple, 294, 319, 320.
Arizona longleaf pine, 400.
ash, 410.
asparagus, 4, 143.
aster, 451.
bachelors button, 433.
bean, 93.
blackberry, 372, 373.
black spruce, 408.
carnation, 434.
Carolina poplar, 426.
China aster, 433.
choke cherry, 413.
clematis, 436.
clover, 253.
coreopsis, 452.
corn, 233.
Corsican pine, 401.
cotton, 128.
cowpea, 256.
Diodia teres, 453.
Euthamia spp., 453.
fig, 384.
flax, 166, 241.
flowering crab, 436.
Gaylussacia sp., 454.
gooseberry, 374.
grape, 361.
green ash, 409.
hawthorn, 418.
Helianthus spp., 455.
hemlock, 397.
hibiscus, 438.
hollyhock, 438.
Impatiens balsamina, 439.
jack pine, 400.
Japanese flowering quince, 444.
juniper, 398.
lima bean, 97.
Linum spp., 242.
usitatissimum, 242.
loblolly pine, 407.
lodgepole pine, 399.
longleaf pine, 401.
matrimony vine, 441.
Monarda fistulosa, 457.
mountain ash, 410.
osage orange, 441.
oxalis, 442.
pansy, 442.
Parthenium integrifolium, 458.
pea, 2, 159.
peach, 342.
Phyllostachys sp., 458.
pitch pine, 403.
plum, 350.
pond pine, 403.
poplar, 428.
Potentilla canadensis, 458.
Psoralea lanceolata, 458.
quince, 330.
raspberry, 371.
red clover, 253.
red pine, 403.
Ribes spp., 459.
rice, 241.
Rocky Mountain juniper, 398.
Rubus parviflorus, 459.
Ruellia strepens, 459.
scrub pine, 407.
shortleaf pine, 400.
Silphium spp., 460.
slash or swamp pine, 399.
snapdragon, 447.
snowberry, 449.
spinach, 161.
spruce, 408.
sunflower, 259.

Taraxacum spp., 460.
Thalictrum dioicum, 461.
timothy, 260.
tobacco, 142.
Vaccinium sp., 461.
Verbesina spp., 461.
western juniper, 397.
western service berry, 429.
white ash, 409.
white cedar, 394.
white poplar, 426.
wild rose, 446.
willow, 430.
yellow cedar, 394.
Rusty spot, barley, 224.
Rutabaga, black rot, 111.
Rye, anthracnose, 166, 217.
bacterial blight, 219.
bacterial leaf spot, 219.
bunt, 219.
crop losses, 462, 465, 466.
ergot, 218, 465, 466.
failure, 219.
head smut, 217.
leaf blotch, 219.
leaf rust, 216, 465, 466.
leaf spot, 219.
powdery mildew, 217.
scab, 217.
Septoria secalis, 219.
smut, 465, 466.
stem rust, 215, 465, 466.
stem smut, 217.
take-all, 219.
Tilletia tritici, 167.

S

Salix spp., (see willow), 430.
Salmon berry, leaf spot, 447.
Salsify, white rust, 161.
Salt-grass, (see Distichlis spicata), 263.
Sambucus glauca, (see elder), 415.
Sand drown, tobacco, 142.
Sap rot, red maple, 421.
white oak, 424.
Sapwood rot, red oak, 425.
Sassafras, leaf spot, 429.
spp., (see sassafras), 429.
Scab, apple, 273, 319, 320, 483.
apricot, 356.
avocado, 386.
barley, 223.
beet, 144.
cherry, 354.
Citrus, 378.
cucumber, 118.
loquat, 388.
oats, 231.
peach, 338, 484, 485.
pear, 326, 486, 487.
pecan, 389.
plum, 350.
potato, 5, 24.
rye, 217.
small cereals, 166.
small grains, 166.
sugar beet, 134.
wheat, 198, 463, 464.
Scald, barley, 223.
potato, 49.
Scaly bark, Citrus, 382.
Scaly Lentinus rot, pine, 407.
Schizonella colemani, Vitis quadrangularis, 461.
Schizophyllum alneum, horsechestnut, 420.
commune, red maple, 421.
Scirpus occidentalis, Clasterosporium caricinum, 459.
Sclerospora graminicola, Chaetochloa italica, 264.
Chaetochloa viridis, 264.
Sclerotial disease, potato, 46.
Sclerotinia carunculoides, mulberry, 375, 424.
celery, 149.
cinerea, apple, 314.
apricot, 355.
cherry, 353, 489.
choke cherry, 413.
peach, 330, 484, 485.
plum, 346, 488.
demissa, western choke cherry, 413.
dry rot, gladiolus, 438.
fuckeliana, primrose, 444.
lettuce, 154.
libertiana, 5.
bean, 5, 96.
cabbage, 109.
carrot, 145.
celery, 148.
cress, 110.
cucumber, 119.
endive, 150.

escarole, 151.
lettuce, 151.
mangel, 155.
potato, 46.
strawberry, 365.
oxycocci, cranberry, 375.
sp., cauliflower, 110.
gladiolus, 438.
lima bean, 97.
peony, 443.
strawberry, 366.
sunflower, 259.
trifoliorum, alfalfa, 248.
clover, 253.
Sclerotiniose, western choke cherry, 413.
Sclerotium batatícola, sweet potato, 87.
bifrons, quaking aspen poplar, 427.
cocos, (see Poria cocos), 407.
disease, wheat, 168.
giganteum, (see Poria cocos), 407.
rhizodes, wheat, 167, 168, 206.
rolfsii, bean, 96.
beet, 145.
cantaloupe, 114.
lettuce, 154.
peanut, 160.
potato, 46.
soybean, 257.
tomato, 65.
sweet potato, 88.
swiss chard, 163.
sp., gladiolus, 438.
Scolecotrichum graminis, Alopecurus pratensis, 264.
timothy, 260.
Scurf, potato, 19.
sweet potato, 86.
Sedum purpureum, stem rot, 459.
Seed certification, potato, 6.
Seedling blight, corn, 166.
wheat, 214.
Seedling rot, sugar beet, 134.
Septobasidium pedicellatum, Citrus, 383.
pinicola, Pinus monticola, 404.
white pine, 404.
retiforme, hackberry, 417.
retiformis, apple, 315.
pear, 328.
sp., hackberry, 417.
Septomyxa negundinis, box elder, 421.
Septoria acicola, loblolly pine, 407.
aesculi, California buckeye, 411.
apii, celery, 146.
avenae, (see Leptosphaeria avenaria), 166, 231.
batatícola, sweet potato, 88.
betulae, birch, 411.
betulicola, western red birch, 410.
betulina, white birch, 411.
blasdalei, cascara, 412.
bromi, Bromus inermis, 167.
chrysanthemi, chrysanthemum, 435.
consimilis, lettuce, 2, 154.
corylina, California hazelnut, 419.
diseases, wheat, 209.
gladioli, gladiolus, 438.
helianthi, sunflower, 259.
irregularis, Rhus diversiloba, 459.
Rhus sp., 459.
lactucae, lettuce, 2, 154.
ludwigiae, Ludwigia alternifolius, 457.
lycopersici, tomato, 3, 53, 478.
negundinis, maple, 421.
nodorum, wheat, 209, 210.
passerinii, barley, 224.
pisi, pea, 3, 158.
potentillarum, (see Mollisia earliana), 363.
pyricola, (see Mycosphaerella sentina), 328.
ribis, currant, 373.
rubi, (see Mycosphaerella rubi), 370, 372.
salmon berry, 447.
thimbleberry, 450.
secalis, rye, 219.
sp., Bromus inermis, 264.
horsechestnut, 420.
Plantago sp., 458.
tritici, wheat, 209, 212.
variegata, (see S. blasdalei), 412.
Sequoia, cankers, 408.
Helotium sphaerophoides, 408.
sempervirens, (see sequoia), 408.
Service berry, fire blight, 429.
Service berry, western, leaf spot, 429.
Nectria disease, 429.
powdery mildew, 429.
rust, 429.
witches broom, 429.

Setaria italica, (see Chaetochloa italica), 264.
viridis, (see Chaetochloa viridis), 264.
Severe mosaic, potato, 4, 41.
Shade trees, 393.
Shoe string, tobacco, 143.
Shot hole, apricot, 356.
California privet, 444.
peach, 344.
syringa, 450.
Silphium spp., rust, 460.
Silver leaf, plum, 351.
Silver scurf, potato, 48.
Slime flux, elm, 417.
Slime mould, celery, 149.
cucumber, 119.
strawberry, 367.
sweet potato, 89.
tomato, 65.
Slimy soft rot, cabbage, 108.
onion, 100.
potato, 48.
Small cereals, scab, 166.
Small fruits, diseases, 357.
Small grains, leaf rusts, 166.
scab, 166.
Smothering disease, hackberry, 417.
Smudge, onion, 99.
Smut, Bromus spp., 264.
corn, 166, 231, 471.
oats, 166, 224.
onion, 3, 5, 97.
rye, 465, 466.
timothy, 260.
Snapdragon, anthracnose, 448.
Cladosporium sp., 449.
mosaic, 449.
Phyllosticta antirrhini, 448.
rust, 447.
stem rot, 449.
Verticillium wilt, 449.
wilt, 449.
Snowberry, powdery mildew, 449.
rust, 449.
Soft rot, bacterial, calla lily, 434.
carrot, 145.
celery, 148.
iris, 439.
onion, 100.
tomato, 67.
turnip, 111.
violet, 450.
Botrytis, sweet potato, 87.
Oidium, tomato, 67.
Rhizopus, guava, 387.
sweet potato, 83.
tomato, 67.
Sclerotinia, cabbage, 109.
vegetables, 6.
Soil and seed treatment, vegetables, 5.
Soil rot, sweet potato, 86.
Solanum nigrum, mosaic, 62.
Sooty blotch, apple, 309.
pear, 328.
plum, 350.
Sooty mold, Citrus, 383.
cotton, 129.
wheat, 215.
Sooty spot, clover, 255.
red clover, 255.
white clover, 255.
Sorbus americana, (see mountain ash), 410.
scopulina, (see mountain ash), 410.
Sore shin, cotton, 128.
Sorghum, anthracnose, 246.
blight, bacterial, 245.
covered kernel smut, 245.
decay of stalk, 246.
head smut, 245.
loose kernel smut, 245.
Sorosporium reilianum, corn, 168, 233.
sorghum, 245.
syntherismae, millet, 264.
Sour sap, pear, 328.
Southern blight, bean, 96.
cantaloupe, 114.
lettuce, 154.
peanut, 160.
potato, 46.
swiss chard, 163.
Soybean, Alternaria atrans, 166, 257.
aphid injury, 257.
bacterial blight, 256.
bacterial leaf spots, 256.
bacterial pustule, 256.
bacterial wilts, 256.
Bacterium solanacearum, 167.
chlorosis, 257.
downy mildew, 256.
mosaic, 167, 168, 257.
necrosis, 257.
Peronospora sp., 166.
trifoliorum, 257.
trifoliorum manshurica, 257.

Phomopsis sojae, 166.
pod blight, 257.
stem blight, 257.
sunburn, 257.
wilt, Fusarium, 257.
Sclerotium, 257.
Sparassis radicata, western white pine, 401.
Spartina pectinata, Claviceps purpurea, 261.
Speckled blotch, oats, 231.
Speckled leaf blotch, wheat, 212.
Sphacelotheca cruenta, sorghum, 245.
sorghi, sorghum, 245.
Sphaerella arbuticola, madrona, 420.
pontederiae, Nymphaea odorata, 457.
rumicis, dock, 453.
Sphaeronema fimbriatum, sweet potato, 82, 83, 477.
Sphaeropsis malorum, (see Physalospora cydoniae), 291, 425.
sp., Austrian pine, 401.
laurel, 440.
white elm, 416.
ulmicola, elm, 417.
vincae, periwinkle, 443.
Sphaerotheca humuli, Humulus sp., 456.
pansy, 442.
raspberry, 371.
spiraea, 449.
strawberry, 365.
humuli fuliginea, Taraxacum spp., 460.
violet, 450.
mors-uvae, gooseberry, 374.
pannosa persicae, peach, 344.
spp., rose, 445.
Sphaerulina trifolii, clover, 254.
Spinach, anthracnose, 162.
blight, 162.
crown rot, 163.
damping off, 162.
downy mildew, 161.
frost injury, 163.
leaf spot, 162.
mosaic, 4, 162.
Puccinia subnitens, 3.
rust, 161.
stunting, 3.
Spindle sprout, potato, 4, 41.
Spindle tuber, potato, 4, 41.
Spiraea douglasii, Cylindrosporium spiraeicolum, 460.
opulifolia aurea, (see spiraea), 449.
powdery mildew, 449.
Split pit, peach, 345.
Spondylocladium atrovirens, potato, 48.
Spongospora subterranea, potato, 48.
Spongy dry rot, apple, 314.
Sporobolus berteroanus, Helminthosporium ravenelii, 262.
Sporonema oxycocci, cranberry, 375.
sp., cranberry, 375.
Spot blotch, barley, 223.
Spot, clover, 255.
Spray burn, apple, 319, 320.
Spray injury, apple, 316.
cantaloupe, 114.
cherry, 355.
Citrus, 383.
peach, 345.
pear, 329.
plum, 351.
potato, 51.
Spread of chestnut blight, 414.
Spruce, black, rust, 408.
Spruce, Engelmann, matting, 408.
needle rust, 408.
stringy brown rot, 408.
Spruce, rust, 408.
Spruce, white, leaf cast, 408.
Spur blight, raspberry, 370.
Squash, downy mildew, 119.
frost injury, 119.
fruit drop, 119.
mosaic, 119.
Rhizopus rot, 119.
wilt, bacterial, 119.
Fusarium, 119.
Stalk rot, bacterial, corn, 166, 168, 238.
corn, 233.
Fusarium, corn, 233.
Gibberella, corn, 233.
rhubarb, 160.
Star melanose, Citrus, 383.
Steganosporium piriforme, maple, 423.
sugar maple, 422.
Stem blight, soybean, 257.
Stem browning, celery, 149.
Stem end rot, Citrus, 380.
mango, 387.
potato, 47.
watermelon, 121.
Stem rot, Fusarium, cabbage, 109.
carnation, 434.

sweet potato, 80, 477.
potato, 19.
Rhizoctonia, bean, 96.
Sclerotinia, cauliflower, 110.
cress, 110.
cucumber, 119.
lima bean, 97.
strawberry, 366.
Sedum purpureum, 459.
snapdragon, 449.
sweet clover, 255.
sweet potato, 5, 477.
velvet bean, 259.
Stem rust, barley, 220, 467, 468.
cereals, 166.
oats, 226, 469, 470.
rye, 215, 465, 466.
wheat, 184, 463, 464.
Stem smut, rye, 217.
Stem spot, asparagus, 144.
Stereum, plum, 351.
sp., white oak, 424.
Sterility, oats, 230.
Stillospora pinicola, lodgepole pine, 400.
Stippen, (see bitter pit), 311.
Stipple streak, potato, 4, 41.
Stizolobium pruriens, leaf spot, 258.
sp., leaf spot, 258.
spp., (see velvet bean), 258.
Stone fruits, diseases, 330.
Storage rots, cranberry, 375.
sweet potato, 477.
Straighthead, rice, 240.
Strawberry, Ascochyta colorata, 364.
Ascochyta fragariae, 364.
frost injury, 362.
fruit rot, 365.
gray mold rot, 365.
leaf scorch, 363.
leaf spot, Dendrophoma, 366.
Mycosphaerella, 362.
Marssonia fragariae, 364.
potentillae, 364.
Mollisia earliana, 364.
nematode, 366.
powdery mildew, 365.
root rot, 365.
Corticium, 366.
rot, Pezizella, 365.
Rhizopus, 365.
Sclerotinia, 365.
slime mould, 367.
stem rot, 366.
yellows, 366.
Streak disease, horse bean, 259.
Streak, potato, 4, 41, 42.
tomato, 65.
Stringy brown rot, Engelmann spruce, 408.
lowland fir, 395.
western hemlock, 397.
Stripe, barley, 222, 467, 468.
tomato, 65.
wheat, 215.
Stripe rust, barley, 166, 221.
grasses, 166.
Hordeum jubatum, 197.
nodosum, 197.
wheat, 166, 196.
Stunting, lettuce, 154, 155.
spinach, 3.
Sub-tropical fruits, 376.
Sudan grass, anthracnose, 260.
Bacillus sorghi, 246.
bacterial blight, 260.
Sugar beet, crown gall, 134.
crown rot, 134.
curly top, 133.
damping off, 134.
dry rot canker, 134.
heart rot, 134.
leaf spot, 132.
mosaic, 134.
Phoma betae, 133.
Phoma rot, 134.
scab, 134.
seedling rots, 134.
Sugar cane, leaf spot, 131.
mosaic, 5, 129.
red rot, 130.
root rot, 131.
white band, 131.
Sulphur heart rot, western larch, 399.
Sulphur sunburn, Citrus, 383.
Sulphur use on seed potatoes, 45.
Sunburn canker, apple, 315.
Sunburn, cotton, 129.
cowpea, 256.
soybean, 257.
Sunflower, dodder, 259.
downy mildew, 259.
leaf spot, 259.
powdery mildew, 259.
rust, 259.
wilt, 259.

Sunscald, apple, 315.
peach, 345.
tomato, 67.
white pine, 404.
Sun scorch, maple, 423.
miscellaneous grasses, 260.
Surface rot, sweet potato, 87.
Sweet clover, anthracnose, 255.
leaf spot, 255.
mosaic, 168, 255.
root knot, 255.
root rot, 255.
stem rot, 255.
wilt, 255.
Sweet pea, black root rot, 450.
mosaic, 450.
powdery mildew, 449.
root rot, Pythium, 450.
Rhizoctonia, 450.
Sweet potato, blackheart, 88.
black rot, 82, 83, 477.
certification, 6, 69.
charcoal rot, 87.
chlorosis, 89.
crop losses, 462, 477.
Cystospora batata, 5.
dry rot, 87.
foot rot, 85, 88, 477.
hollow heart, 87.
Java black rot, 87.
leaf spot, 88.
Macrosporium solani, 3.
miscellaneous injuries, 87.
miscellaneous tuber rots, 87.
mosaic, 88.
pithiness, 87.
pox, 86, 477.
root knot, 88.
rot, 87.
Sclerotium wilt, 88.
scurf, 86.
slime mould, 89.
soft rot, 83, 87.
soil rot, 86.
stem rot, 5, 80, 477.
storage rots, 477.
surface rots, 87.
Texas root rot, 88.
tuber injuries, 87.
tuber rots, 87.
white rust, 88.
Swiss chard, bacterial disease, 3, 163.
curly top, 163.
leaf spot, 163.
Pseudomonas aptatum, 163.
root knot, 163.
southern blight, 163.
Sycamore, anthracnose, 429.
canker, 430.
drought injury, 430.
powdery mildew, 430.
winter killing, 430.
Symphoricarpos orbiculatus, (see snowberry), 449.
racemosus, (see snowberry), 449.
spp., (see snowberry), 449.
Synchitrium endobioticum, potato, 17.
myosotidis, Cryptantha intermedia, 452.
papillatum, Erodium moschatum, 453.
sp., Lotus spp., 457.
Syntherisma sanguinalis, Piricularia grisea, 262.
Syringa, shot hole, 450.
spp., (see lilac), 440.
Microsphaera alni, 441.

T

Take-all, rye, 219.
timothy, 260.
wheat, 166, 203.
Taphrina amentorum, (see Exoascus tosquinetii), 409.
aurea, black cottonwood poplar, 427.
cerasi, western choke cherry, 413.
coerulescens, oak, 425.
water oak, 425.
sp., oak, 425.
Taraxacum spp., leaf spot, 461.
powdery mildew, 460.
rust, 460.
Tar leaf spot, Acer rubrum, 423.
Acer saccharinum, 423.
maple, 423.
Tar spot, quaking aspen poplar, 427.
Vaccinium corymbosum, 461.
willow, 431.
Taxus brevifolia, (see western yew), 408.
Tear stain, mango, 387.
Temperature, by months, 270.
departure from normal, 271.
Texas root rot, bean, 96.

cotton, 126.
elm, 417.
grape, 361.
mulberry, 375.
okra, 155.
peanut, 160.
sweet potato, 88.
wild rose, 446.
Thalictrum dioicum, rust, 461.
Thelephora retiformis, (see Septobasidium retiforme), 417.
Thielavia basicola, horseradish, 110.
pea, 157.
sweet pea, 450.
tobacco, 138, 142.
violet, 450.
watermelon, 123.
bean, 2.
Thimbleberry, leaf spot, 450.
Macrophoma sp., 450.
Thuja occidentalis, (see arborvitae), 394.
plicata, (see giant arborvitae), 394.
Tilia americana, (see basswood), 410.
sp., (see basswood), 410.
Tilletia laevis, wheat, 169, 463, 464.
tritici, rye, 169, 219.
wheat, 169, 463, 464.
Timothy, leaf spot, 260.
proliferation of spike, 260.
rust, 260.
smut, 260.
take-all, 260.
zonate eye-spot, 260.
Tipburn, lettuce, 152.
potato, 37, 475, 476.
Tobacco, angular spot, 2, 137.
bacterial leaf spot, 3.
bacterial wilt, 142.
blackfire, 137.
black root rot, 138.
broad leaf spot, 142.
brown spot, 143.
damping off, 143.
frenching, 143.
frogeye, 142.
Fusarium sp., 142.
hieroglyphics, 142.
leaf spots, 142, 143.
Cercospora, 142.
Phyllosticta, 143.
magnesium hunger, 142.
mosaic, 140.
pole sweat, 142.
ring spot, 142.
root knot, 143.
root rot, 5.
rust, 142.
sand drown, 142.
shoe string, 143.
water injury, 142.
white speck, 143.
wildfire, 2, 6, 135.
wind injury, 142.
Wisconsin leaf spot, 142.
Tomato, Alternaria, 3.
Alternaria spot, 67.
anthracnose, 66.
bacterial blight, 64.
bacterial soft rot, 67.
bacterial spot, 66.
bacterial wilt, 65, 478.
Bacterium vesicatorium, 2.
Basisporium gallarum, 3, 67.
blossom drop, 67.
blossom end rot, 62.
buckeye rot, 66.
catface, 67.
collar blight, 65.
crop losses, 478.
damping off, 65.
diseases of fruit or blossom, 66.
diseases of stem, 65.
early blight, 59, 478.
frost injury, 65.
fruit spots, 67.
Fusarium wilt, 3, 55, 478.
hollow stem, 65.
late blight, 66.
leaf mold, 64.
leaf roll, 65.
leaf spot, 53.
lightning injury, 66.
mosaic, 5, 61.
nailhead spot, 59.
Phoma fruit rot, 66.
references on diseases, 67.
root knot, 64.
Sclerotium blight, 65.
Septoria blight, 478.
Septoria lycopersici, 3.
slime mould, 65.
soft rot, 67.
streak, 65.
stripe, 65.

sunscald, 67.
western yellow blight, 2, 59.
wilt, 5.
Fusarium, 3, 55, 478.
winter blight, 65.
winter injury, 66.
Top soursap, plum, 351.
Trametes pini, Douglas fir, 395.
western hemlock, 397.
western larch, 399.
western white pine, 401.
robiniophila, locust, 420.
suaveolens, large toothed aspen poplar, 426.
willow, 431.
Trichoderma koningi, sweet potato, 87.
Trifolium carolinianum, rust, 253.
Tsuga albertiana, (see hemlock), 396, 397.
canadensis, (see hemlock), 396.
heterophylla, (see western hemlock), 397.
spp., (see hemlock), 397.
Tubercularia fici, fig, 386.
sp., horsechestnut, 420.
vulgaris, (see Nectria vulgaris), 459.
Tuber injuries, sweet potato, 87.
Tuber rots, potato, 47.
sweet potato, 87.
Tuckahoe, pine, 407.
Turnip, leaf spots, 111.
Rhizoctonia, 111.
soft rot, 111.
white rust, 111.
Twig blight, elm, 417.
pear, 328.
white elm, 416.
Twig canker, asparagus, 144.
Twig rust, hemlock, 397.
Tylenchus dipsaci, clover, 168, 254.
strawberry, 366.
tritici, wheat, 167, 207.

U

Ulmus alata, (see wing elm), 415.
americana, (see white elm), 416.
pubescens, (see slippery elm), 416.
spp., (see elm), 416.
Uncinula ampelopsidis, (see U. necator), 432.
flexuosa, horsechestnut, 420.
necator, ampelopsis, 432.
grape, 359.
salicis, black cottonwood poplar, 427.
poplar, 428.
quaking aspen poplar, 427.
willow, 431.
Undetermined disease, eggplant, 150.
pea, 159.
rhubarb, 160.
Uredinopsis mirabilis, balsam fir, 395.
brake fern, 454.
lowland fir, 395.
Osmunda claytoniana, 395.
silver fir, 394.
Urocystis agropyri, Agropyron repens, 264.
Agrostis palustris, 167, 264.
Melica imperfecta, 264.
cepulae, onion, 97.
occulta, rye, 217.
tritici, wheat, 167, 181.
Uromyces appendiculatus, bean, 93. 256.
cowpea, 256.
lima bean, 97.
caryophyllus, carnation, 434.
dactylidis, Dactylis glomerata, 167, 264.
grasses, 167.
elegans, clover, 253.
Trifolium carolinianum, 253.
fallens, clover, 253.
red clover, 253.
medicaginis, Medicago lupulina, 247.
Medicago sativa, 247.
(see U. striatus), 247.
pea, 2.
pisi, pea, 159.
spp., clover, 253.
Euphorbia spp., 453.
striatus, alfalfa, 167, 247.
trifolii, clover, 253.
white clover, 253.
Urophlyctis alfalfae, alfalfa, 248.
Use of sulphur, potato, 45.
Ustilago avenae, oats, 224, 469, 470.
hordei, barley, 219, 467, 468.
levis, oats, 224, 469, 470.
neglecta, Chaetochloa lutescens, 264.
nuda, barley, 220, 467, 468.

panici-miliacei, Panicum miliaceum, 264.
sp., rye, 217, 465, 466.
striaeformis, Poa pratensis, 264.
timothy, 260.
tritici, wheat, 176, 463, 464.
zeae, corn, 231, 471.

V

Vaccinium corymbosum, tar spot, 461.
sp., rust, 461.
spp., leaf rust, 461.
Valsa leucostoma, peach, 344.
Varietal susceptibility notes, 4.
Vegetable crops, 1, 143.
diseases, 1.
geographical distribution, 2.
new areas, 2.
proliferation of heads, wheat, 215.
soft rot, 5.
soil and seed treatment, 5.
Velvet bean, bacterial leaf spot, 258.
Cercospora sp., 258.
leaf spot, 258.
root knot, 259.
stem rot, 259.
Venturia compacta, cranberry, 375.
inaequalis, apple, 273, 483.
pyrina, pear, 326, 486, 487.
Verbesina spp., rust, 461.
Vermicularia varians, potato, 46.
Verticillium albo-atrum, eggplant, 150.
okra, 155.
peach, 344.
potato, 47.
snapdragon, 449.
sp., maple, 423.
Norway maple, 421.
snapdragon, 449.
Vetch, Protocoronospora nigricans, 258.
Vicia americana, powdery mildew, 461.
faba, (see horse bean), 259.
sp., (see vetch), 258.
Vinca major, (see periwinkle), 443.
sp., (see periwinkle), 443.
Vine rot, bean, 96.
Viola spp., (see violet), 450.
tricolor, (see pansy), 442.
Violet, black root rot, 450.
leaf spot, 450.
powdery mildew, 450.
soft rot, 450.
Violet root rot, alfalfa, 249.
Vitis quadrangularis, Schizonella colemani, 461.
Volutella buxi, box, 434.
nectrioides, choke cherry, 413.

W

Walnut, blight, 391.
canker, 391.
leaf spot, 430.
Melanconium oblongum, 430.
Wart, potato, 4, 17.
Washingtonia filifera, Phoma palmicola, 450.
Water core, apple, 312.
Water injury, tobacco, 142.
Watermelon, abnormal proliferated blossoms, 123.
anthracnose, 6, 120.
blossom end disease, 3.
blossom end rot, 121.
decay, 122.
downy mildew, 123.
drought injury, 123.
hail injury, 123.
leaf spots, 123.
mosaic, 123.
Pythium debaryanum, 122.
Rhizoctonia, 3, 123.
root knot, 123.
stem end rot, 121.
Thielavia basicola, 123.
wilt, 123.
Fusarium, 122.
Watery soft rot, carrot, 145.
celery, 148.
endive, 150.
escarole, 151.
Weather conditions in 1922, 165, 269.
Western fusiform rust, lodgepole pine, 399.
Western pine gall rust, Indian paint brush, 456.
lodgepole pine, 399.
western yellow pine, 402.
Western yellow blight, tomato, 2, 59.
Wheat, anthracnose, 166, 209.
basal glume rot, 215.
black chaff, 208.
black point, 214.
broken straw, 214.
bunt, 166, 169, 463, 464.

crinkled joint, 215.
crop loss, 462, 463, 464.
diseases caused by Septoria spp., 209.
ergot, 166, 212.
flag smut, 167, 180, 181.
foot and root rots, 206.
foot rots, 206, 207.
glume blotch, 210.
Helminthosporium blight, 206, 207.
leaf rust, 192, 463, 464.
Leptosphaeria, 207.
sp., 166.
loose smut, 176, 463, 464.
mosaic, 166, 168, 215.
nematode, 166, 207.
powdery mildew, 214.
root rot, 206, 207.
rosette, 205.
scab, 198, 463, 464.
Sclerotium disease, 168.
rhizodes, 167, 206.
seedling blight, 214.
Septoria diseases, 209.
nodorum, 209, 210.
tritici, 209.
sooty mold, 215.
speckled leaf blotch, 212.
stem rust, 184, 463, 464.
stripe, 215.
stripe rust, 166, 196.
take-all, 166, 203.
Tylenchus tritici, 167.
Urocystis tritici, 167.
vegetable proliferation of heads. 215.
white head, 207.
Wojnowicia graminis, 206.
White band, sugar cane, 131.
White butt rot, maple, 423.
White clover, (see clover), 250.
rust, 253.
sooty spot, 255.
White head, wheat, 207.
White heart, lettuce, 154.
White heart rot, locust, 420.
red alder, 409.
willow, 431.
White heartwood rot, Oregon maple, 421.
White pine blister rust, black currant, 405.
control in Pennsylvania, 405.
Ribes cynosbati, 405.
nigrum, 405.
Ribes rotundifolium, 405.
western white pine, 401.
white pine, 404.
White pouch fungus, yellow pine, 402.
White rust, Bursa-bursa pastoris, 451.
horseradish, 110.
mustard, 110.
radish, 111.
salsify, 161.
sweet potato, 88.
turnip, 111.
White speck, tobacco, 143.
White tip, carnation, 435.
cucumber, 119.
White top, alfalfa, 249.
White wood, paper birch, 411.
wildfire, tobacco, 2, 6, 135.
Wild grasses, Puccinia glumarum, 263.
Wild oats, (see Avena sp.), 262.
Willow, Amphisphaeria decolorans, 431.
canker, 431.
crown gall, 431.
European canker, 431.
leaf blotch, 451.
Melampsora sp., 431.
powdery mildew, 451.
rust, 430.
tar spot, 431.
Trametes suaveolens, 431.
white heart rot; 431.
Wilt, bacterial, cantaloupe, 112, 114.
corn, 237.
cosmos, 436.
cucumber, 114.
dahlia, 435.
parsley, 155.
peanut, 159.
pepper, 160.
potato, 46.
soybean, 256.
squash, 119.
tobacco, 142.
tomato, 65, 478.
cantaloupe, 114.
flax, 166.
Fusarium, carnation, 434.
China aster, 433.
cotton, 124, 481.
cowpea, 256.
cucumber, 119.
flax, 243.

golden seal, 454.
larkspur, 440.
okra, 155.
potato, 14, 47, 475, 476.
snapdragon, 448.
soybean, 357.
squash, 119.
tomato, 3, 55, 478.
watermelon, 122.
Sclerotinia, sunflower, 259.
Sclerotium, bean, 96.
beet, 145.
soybean, 257.
sweet potato, 88.
sweet clover, 255.
tomato, 5.
Verticillium, eggplant, 150.
maple, 423.
Norway maple, 421.
okra, 155.
peach, 344.
potato, 47.
snapdragon, 449.
watermelon, 123.
Wind injury, apple, 316.
tobacco, 142.
Winter blight, tomato, 65.
Winter injury, apple, 316.
blackberry, 373.
cherry, 355.
Festuca spp., 265.
maple, 424.
raspberry, 371.
tomato, 66.
wild rose, 447.
Winter killing, sycamore, 430.
Wisconsin leaf spot, tobacco, 142.
Witches broom, hackberry, 417.
hickory, 419.
rhododendron, 444.
western service berry, 429.
western yellow pine, 401.
white oak, 424.
Witch-hazel, leaf spot, 431.
Wither tip, Citrus, 381.
Wojnowicia graminis, Agropyron smithii, 265.
wheat, 206.
Wood rot, arborvitae, 394.
mountain maple, 422.
paper birch, 411.
poplar, 429.
red pine, 403.
white ash, 409.
white elm, 416.
white pine, 403.
Work on mosaic diseases, 4.

X

Xylaria sp., apple, 310.
hackberry, 417.

Y

Yeast, elm, 417.
Yeast spot, lima bean, 97.
Yellow dwarf, potato, 3, 43.
Yellowing, cabbage, 109.
Yellow leaf blister, black cottonwood poplar, 427.
Yellow leaf blotch, alfalfa, 248.
Yellow root rot, western white pine, 401.
Yellows, alfalfa, 249.
cabbage, 4, 102.
celery, 2, 4, 147.
China aster, 433.
dahlia, 435.
kale, 110.
peach, 343.
plum, 350.
strawberry, 366.
Yellow speck, corn, 240.
Yew, western, heart rot, 408.
needle blight, 408.
Yucca, Neottiospora yuccaefolia, 451.
sp., (see Yucca), 451.

Z

Zantedeschia sp., (see calla lily), 434.
Zinnia, powdery mildew, 451.
sp., (see zinnia), 451.
Zonate eye-spot, timothy, 260.

ERRATA AND EXPLANATION

Page

17, 452, 453, and 457. Read "Synchitrium" instead of "Synchytrium".

55, 150 and 382. Read "Phytophthora terrestris" instead of "P. terrestria".

167, 168 and 206. Read "Sclerotium rhizodes" instead of "S. rhizoides".

244 Read "Phlyctaena" instead of Phylctaena".

315 Read "Septobasidium retiforme" instead of "S. retiformis".

344 Read "Cercospora circumscissa" instead of "S. circumcissa".

363 Read "Marssonia" instead of "Marsonia".

383 Read "Septobasidium pedicellatum" instead of "S. pedicillatum".

394 Read "Phomopsis juniperovora" instead of "P. junoperivora".

402 Read "Pine comandra rust" instead of "Pine commandra rust".

410 Read "Ramularia fraxinea" instead of "R. fracinea".

412 Read "Diaporthe juglandis" instead of "Diaporthae juglandis".

Read "Puccinia rhamni" instead of "P. rahmni".

415 Read "Nummularia" instead of "Numularia".

416 Read "Phyllactinia corylea" instead of "Phyllactina corylea".

417 Read "Irpex tulipiferae" instead of "I. tulipeferae".

Read "Septobasidium retiforme" instead of "S. retiforma".

Read "Thelephora retiformis" instead of "Telephora retiformis".

422 Read "Steganosporium piriforme" instead of "Stegamosporium piriforme".

Read "Acer saccharinum" instead of "A. saccharium".

Read "Gloeosporium saccharinum" instead of "G. saccharina".

423 Read "Steganosporium piriforme" instead of "Stegnosporium piriforme".

Page

433 Read "Fusarium conglutinans callistephi" instead of "callestephi".

Read "Philospora sp. instead of "Philospera".

434 Read "Bacillus carotovorus aroideae" instead of "aroideal".

436 Read "Oidium evonymi" instead of "O. evonynui".

439 Read "Phyllosticta hydrangeae" instead of "P. hydrangea".

445 Read "Melampsoropsis rhododendri" instead of "M. rhodeodendri".

449 Read "Symphoricarpos" instead of "Symphoricarpus".

451 Read "Neottiospora yuccaefolia" instead of "Heottiospora yuccaefolia".

452 Read "Cylindrosporium ceanothi" instead of "C. ceanthi".

456 Read "Arctostaphylos uva-ursi" instead of "Arctostophylos uva-ursa".

Read "Ledum groenlandicum" instead of "L. groenlaudicum".

459 Read "Ruellia" instead of "Ruella".

Read "Puccinia ruelliae" instead of "P. ruellia".

461 Read "Thalictrum dioicum" instead of "T. diocium".

Read "Rhytisma vaccinii" instead of "R. vaccini".

Read "Vaccinium corymbosum" instead of "V. corybosum".

478 Read "Bacterium solanacearum" instead of "Bacillus solanacearum".